RESTRICTED

TM 11-350

WAR DEPARTMENT

TECHNICAL MANUAL

TELEPHONE SWITCHBOARD BD-116-B

January 30, 1943

WAR DEPARTMENT
WASHINGTON, 1/30/43

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TELEPHONE SWITCHBOARD BD-116-B

Prepared under the direction of
the Chief Signal Officer

X-61889
Issue 1

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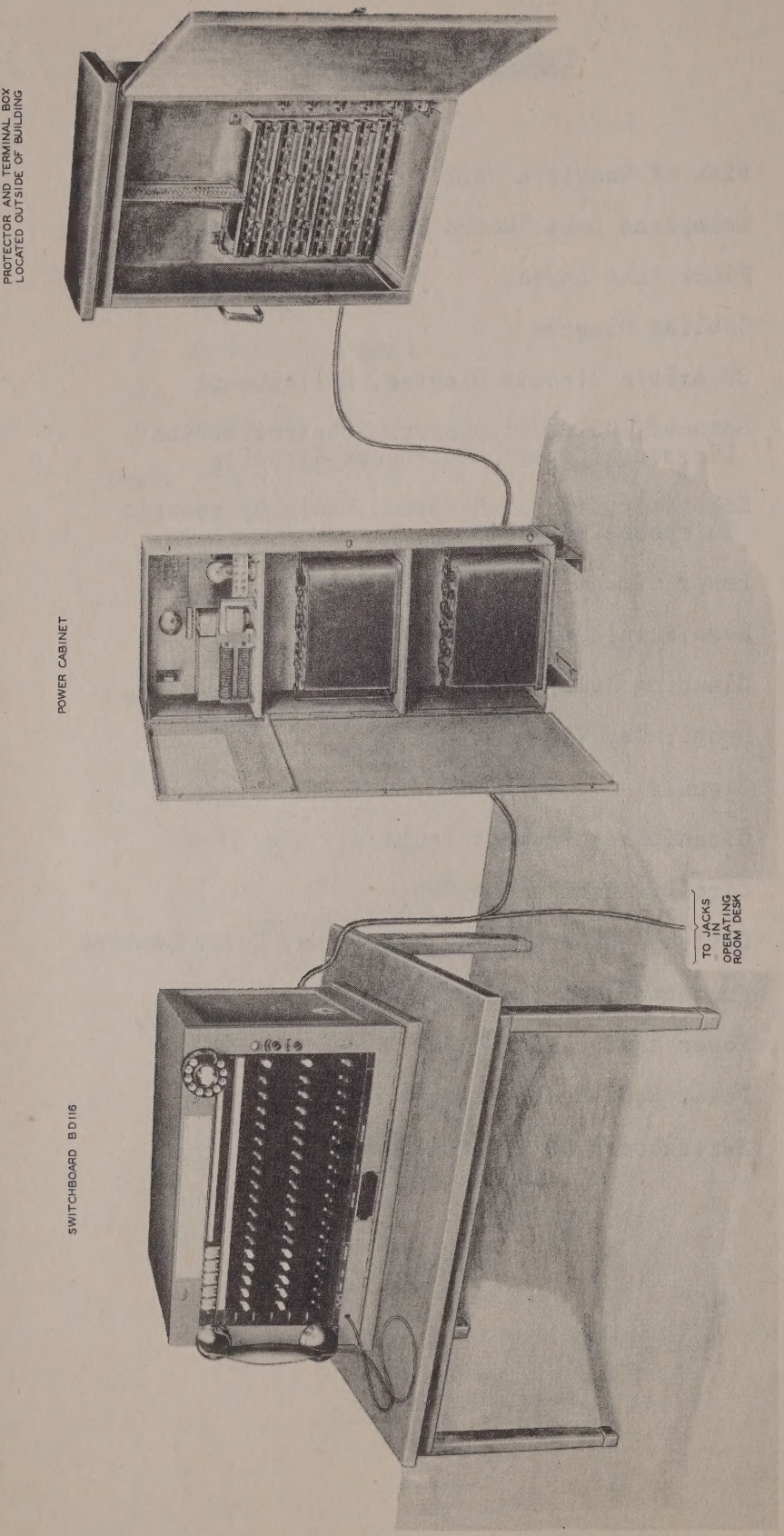


Figure 1 - View of Complete Unit

SECTION I

DESCRIPTION

1. GENERAL DESCRIPTION.

a. General.—Telephone Switchboard BD-116-B (see fig. 1) comprises a complete telephone exchange consisting of a switchboard, protector, and terminal box, and power plant which is designed for use with Radio Set SCR-588-B. The telephone switchboard is a single-position switchboard arranged to be mounted on a table. The equipment may be installed anywhere under cover (see fig. 3).

b. Component Parts.

Quan.	Article	Approximate Size	Approximate Weight in Pounds
1	Switchboard BD-116-B	24-11/16"x 15-3/8"x 14-3/8"	130
1	Protector and Terminal Box JB-66	18-1/4"x 11-3/4"x 29-19/32"	60
1	Power Plant PE-166, including 2 batteries, rectifier, and ringing generator	18"x9"x48"	250
11	Jacks	Negligible	Negligible

c. Switchboard BD-116-B (See Figs. 2 and 15).—Switchboard BD-116-B is a single-position, turret-type, manually-operated, cordless telephone switchboard. It is designed to establish telephone connections between local stations and a special controller telephone set, and between these stations and a manual or dial common battery central office and other army switchboards with magneto ringing. In addition, the switchboard may be used to connect a special liaison-officer's telephone circuit to a magneto trunk and to connect a special radio operator's circuit to another magneto trunk. Instead of using cords, connections are completed by the throwing of a key lever in each station line or trunk over which it is desired to communicate. These keys are mounted in a vertical position, together with the drops and signals, in the front panel (see fig. 2). The relay equipment for the switchboard and special telephone sets is located on mounting plates supported by details in the back of the switchboard turret (see fig.15). Screw-type terminals are mounted on a terminal strip in the rear of the turret to permit outside connections to the

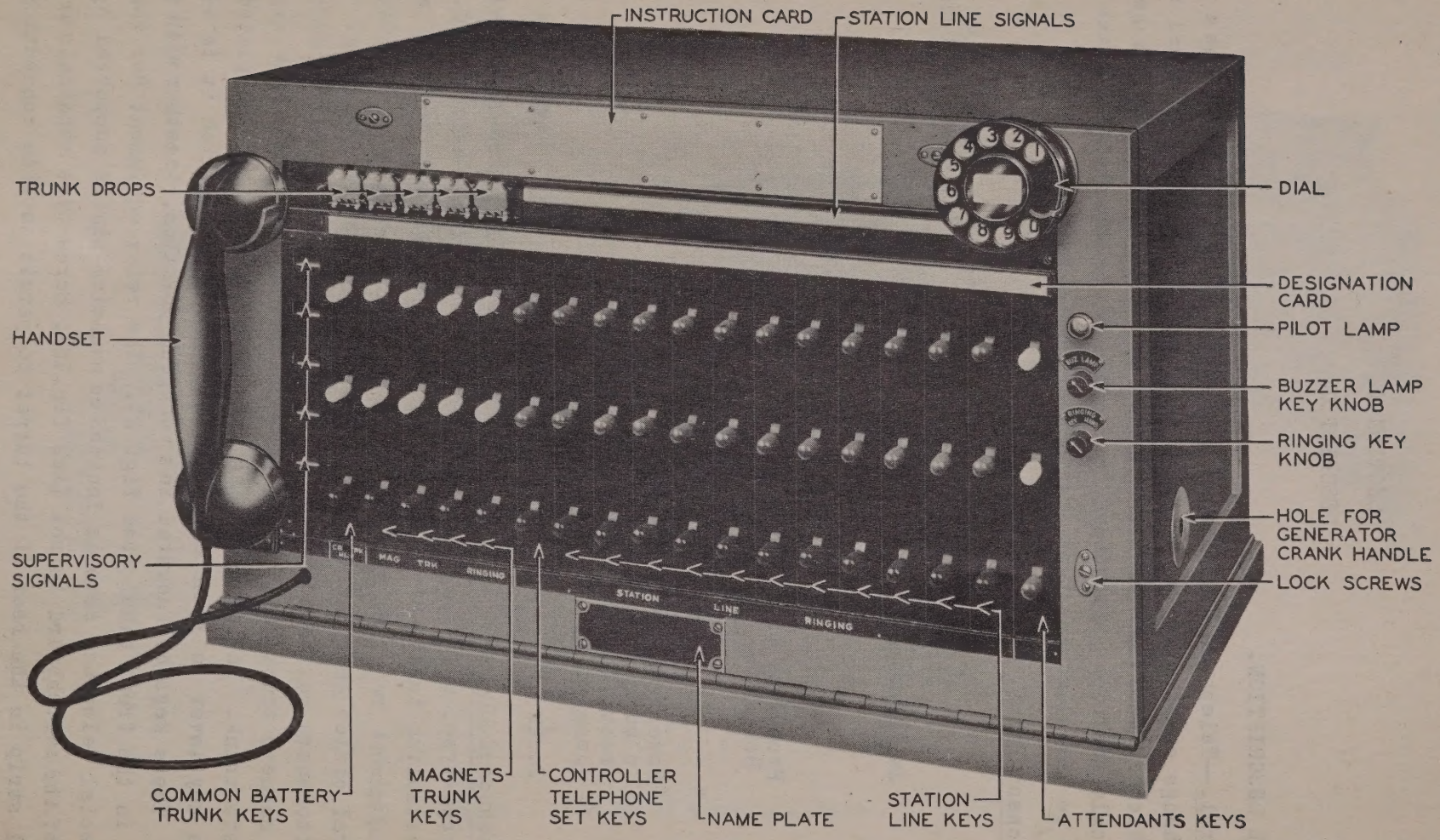


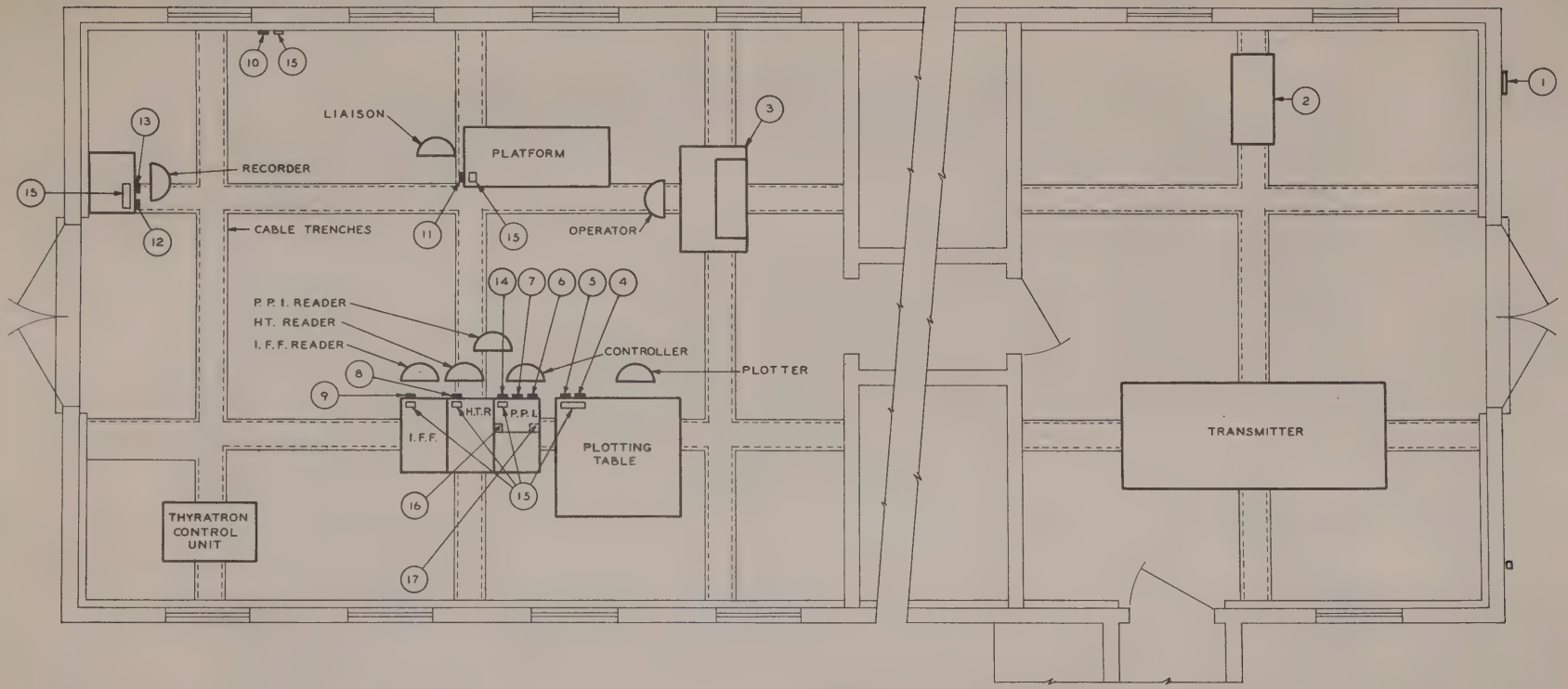
Figure 2 - Telephone Switchboard BD-116-B, Front View

protector cabinet and inside connection to the controller switching key, liaison officer and radio operator jacks, and ringing supply leads. Power leads must be soldered to another set of terminal posts on the floor of the switchboard. Each switchboard consists of the following equipment:

Quan.	Article
1	Operator's position
1	Attendant's telephone circuit (with dial)
11	Station line circuits
1	Common battery central office trunk
4	Magneto central office trunks or magneto trunks to another Signal Corps switchboard
5	Connecting circuits
1	Controller's telephone circuit
1	Liaison officer's telephone circuit
1	Radio operator's telephone circuit
1	Buzzer circuit (night operation)
1	Pilot lamp (normal operation)
1	Emergency ringing generator
18	Key units (3 keys per unit)

d. Protector and Terminal Box JB-66 (See Fig. 16).—This protector and terminal box is for use with one Switchboard BD-116-B. It is essentially a 30-line weatherproof protector box which is arranged for mounting on the outside of a building. Each line is provided with carbon-block arresters and heat coils. A series of binding posts is provided for terminating the field lines and incoming trunks from the central office or other army switchboards. These binding posts are permanently wired to protectors. Lugs are provided at the protectors for wiring to Switchboard BD-116-B.

e. Power Equipment PE-166 (See Fig. 17).—The power equipment consists of two 6-cell batteries for furnishing 24-volt direct current to the switchboard, a full-wave rectifier for charging storage batteries, a ringing generator, and a metal case to completely enclose all equipment. Fuses are provided for the switchboard, controller, liaison officer, and radio operator current supplies. Lugs are provided for wiring to these circuits and splicing leads are provided in a conduit box for connecting to an a-c supply.



L E G E N D

1 - TERMINAL BOX
2 - BATTERY CABINET AND RINGING SUPPLY
3 - TELEPHONE SWITCHBOARD WITH PHONE, DIAL, AND GENERATOR
4 - PLOTTER JACKS (TRANS. AND REC.)
5 - PLOTTER INST. JACK (REC. ONLY)
6 - CONTROLLER JACKS (TRANS. AND REC.)
7 - CONTROLLER JACK (REC. ONLY)
8 - HEIGHT READER JACK (TRANS. AND REC.)
9 - I.F.F. READER JACKS (TRANS. AND REC.)
10 - INSTRUCTION JACK (REC. ONLY)
11 - LIAISON JACKS (TRANS. AND REC.)
12 - RECORDER JACK (REC. ONLY)
13 - RECORDER INST. JACK (REC. ONLY)
14 - P.P.I. JACK (TRANS AND REC.)
15 - NAME PLATE
16 - SWITCHING KEY NO. 1
17 - SWITCHING KEY NO. 2

Figure 3 - Floor Plan Layout

SECTION II

EMPLOYMENT

2. EQUIPMENT LAYOUT.

a. The equipment shall be located in accordance with floor plan layout as shown in figure 3.

3. SETTING UP AND CONNECTING EQUIPMENT.

a. Remove the equipment from the cases and crates with extreme care. The cases are opened by removing the flathead machine screws or nails along the edges of the cases. Using care at all times in handling the equipment will greatly minimize maintenance troubles in the operation of the equipment.

b. Place the switchboard in the location shown on floor plan layout (fig. 3). If another location is necessary, check to see that it is satisfactory from the following standpoints:

(1) A dry location is necessary. Do not place the switchboard under a window where rain might enter. Avoid a location adjacent to or under steam or water pipes where moisture from sweating might penetrate the board in time.

(2) Dusty places or locations where corrosive fumes are likely to be present should be avoided.

c. Remove cord which is tied around drop in the upper left-hand face of the switchboard. Loosen four lock screws in front panel (see fig. 2) and one lock screw in rear panel and remove cover from switchboard. Inspect switchboard for loose or damaged parts.

d. Place the power cabinet in location as shown on floor plan (fig. 3). Make a visual inspection of all power equipment to see that fuse and ballast lamps are installed and are in good condition. (Connect vent pipe to outlet in side on building.)

e. Install protector and terminal box on the outside of the building as shown on floor plan drawing (fig. 3). Open cover and examine protectors and binding posts for damaged or loose parts. Replace all heat coils and carbon protector blocks that appear damaged. Fasten the box to the wall of the building. Drill hole in suitable location in box to accomodate cable to switchboard.

f. Install jacks in location indicated on floor plan layout (fig. 3).

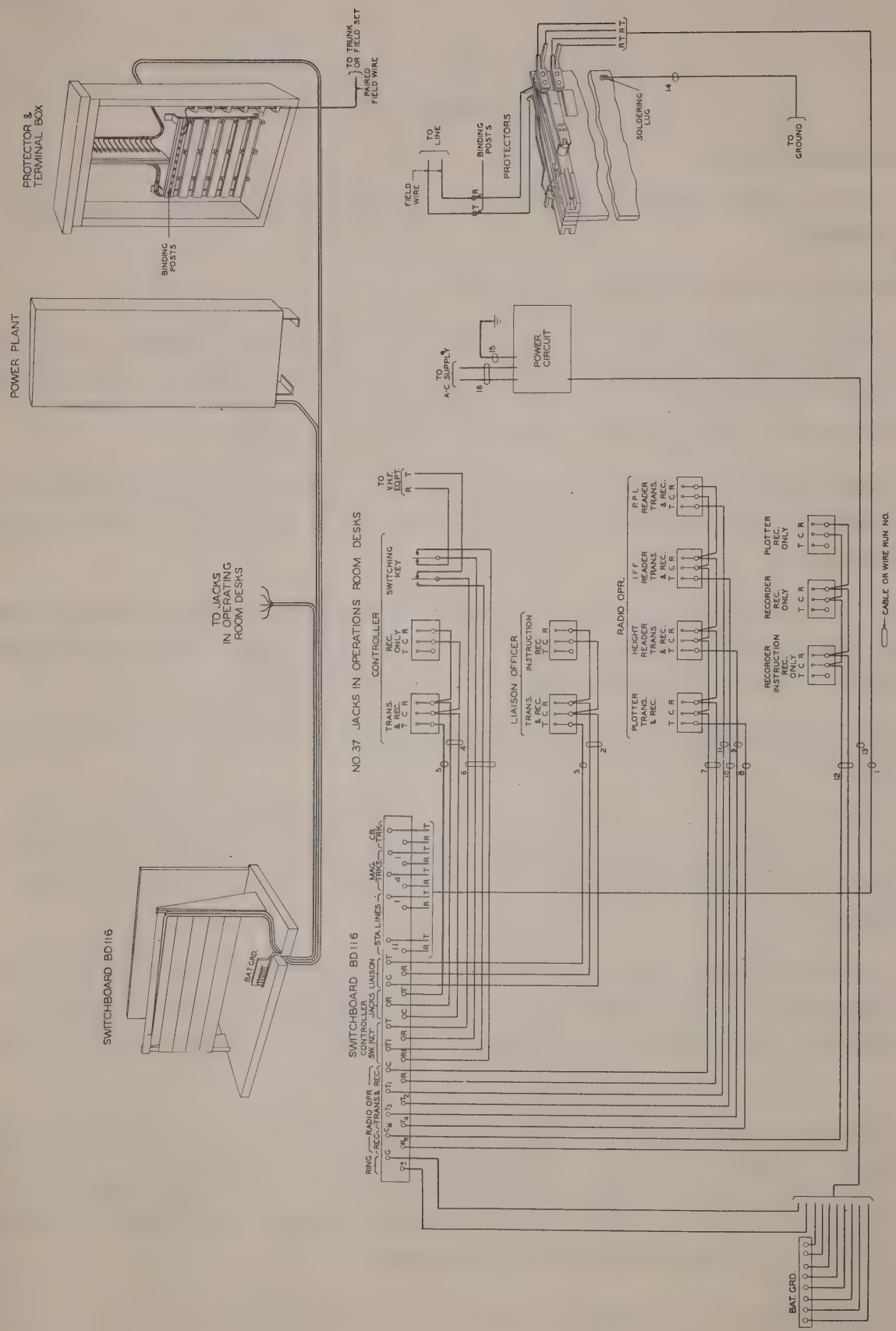


Figure 4 - Cabling Diagram

g. Install cable or wiring as follows (see fig. 4):

Cable or Wire No.	From	To	Cable or Wire	Notes
1	Switchboard Terminal Strip	Protector and terminal box	21-pair cable	(1)
2		Liaison officer's jacks (transmitter and receiver) and instruction jacks (receiver only)	1-pair inside cable	
3		Liaison officer's jacks (transmitter and receiver)	Single inside wire	(2)
4		Controller jacks (transmitter and receiver, and receiver only)	1-pair inside wire	
5		Controller jacks (transmitter and receiver)	Single inside wire	(2)
6		Controller switching key	2-pair inside wire	
7	Switchboard Terminal Strip (Radio Operator)	Plotter (transmitter and receiver), height reader, I.F.F. and P.P.I. (transmitter and receiver) jacks	1-pair inside wire	
8	Switchboard Terminal Strip	Plotter (transmitter and receiver) jack	Single inside wire	(2)
9		Height reader (transmitter and receiver) jack	Single inside wire	(2)
10		I.F.F. (transmitter and receiver) jack	Single inside wire	(2)
11		P.P.I. (transmitter and receiver) jack	Single inside wire	(2)
12		Recorder, Instruction, and Plotter (receiver only) jacks	1-pair inside wire	
13		Power Plant	5-pair inside wire	(3)
14	Protector Mounting Ground Lug	Ground	Single conductor	(4)
15	Ground Stud in Power Plant	Ground	Single conductor	(5)
16	Splicing Leads in Conduit Box at bottom of cabinet	Power service	2-conductor	(6)

Notes referred to in paragraph 3g.

(1) 21 pairs (including 5 spares) lead-covered, 22-gauge cable with double cotton and lacquered insulation is recommended, (see fig. 4).

(2) Transmitter battery connection of transmitting and receiving jacks.

(3) Four 20-gauge paired wires, or equivalent, are recommended for battery and ground. All connections should be soldered. Regular paired inside wire may be used for ringing leads.

(4) One no. 10 stranded ground wire or approved equivalent is recommended. All connections should be soldered. Use one piece of wire without joints. Clean ends of wire, removing all traces of dirt, grease, or foreign matter before soldering connections.

(5) One no. 6 stranded ground wire.

(6) 2-conductor BX or equivalent (see par. 3h).

h. Power Connections.—Before making any electrical connections, be sure that the a-c service is 105-125 volts at 60 cycles. If there is any doubt about the voltage and frequency of the commercial source of a-c power, consult the local power company. Connect the power leads as directed in paragraph 3g. The BAT CO switch should be left open. Install the battery and connect battery leads. The battery should be filled with electrolyte and given an initial charge as covered in paragraph 21a(1) and (2). Throw the BAT CO switch to the ON position to furnish battery power to the switchboard.

4. PREPARATION FOR USE.

a. General Inspection.—(1) Check for loose leads on the switchboard, terminal box, and power cabinet.

(2) Check to see that all fuse posts are equipped with fuses.

(3) Check to see that the ringing-generator resistance lamp and the hand-generator handle are in their proper places.

(4) To assure proper operation of the relays, make the switchboard approximately level.

(5) See that all relay covers are in their proper places.

(6) Check the cable to see that it does not interfere with the opening and closing of the front panel or cover.

(7) Make visual inspection to see that all keys are in normal position.

Note: Relays, drops, and signals do not require the application of a current flow test at the time of installation.

b. Circuit Operation Tests.—Any of the circuit operation tests described in paragraph 19 may be applied as a further check if desired, before putting the switchboard into operation.

5. SWITCHBOARD OPERATION.

a. General.—The operation of the switchboard is similar to the usual commercial practice. There are five connecting circuits which permit the establishment of five simultaneous talking connections. In addition to these five, there are special connections which can be made between the liaison officer, controller, and ringdown trunk no. 3, and between the radio operator and ringdown trunk no. 4. Some of the local stations and special circuits have more than one phone hooked in parallel across the lines.

(1) The horizontal rows of key levers control the connecting circuits. The throwing of two key levers in the same horizontal row in the same direction connects the two stations associated with the keys through a particular connecting circuit. For schematic diagram see figure 5.

(2) The following table identifies the functions of the various keys, both for connecting through the five connecting circuits and for special circuits.

Key No. (L. to R.)	Lever Thrown	Connection
1-3 (top horizontal row)	Upward	Connecting circuit A
4 (top horizontal row)	Upward	Connects liaison officer's telephone circuit to ringdown trunk no. 3
5 (top horizontal row)	Upward	Connects radio operator's telephone circuit to ringdown trunk no. 4
6 (top horizontal row)	Upward	Connects liaison officer's telephone circuit to controller's telephone circuit
7-18 (top horizontal row)	Upward	Connecting circuit A
1-18 (top horizontal row)	Downward	Connecting circuit B
1-18 (middle horizontal row)	Upward	Connecting circuit C
1-18 (middle horizontal row)	Downward	Connecting circuit D
1-18 (bottom horizontal row)	Upward	Connecting circuit E
1 (bottom horizontal row)	Downward	Holding circuit on common battery trunk
2-17 (bottom horizontal row)	Downward	Ringing circuit
18 (bottom horizontal row)	Downward	Not used

b. Answering Incoming Calls.—Incoming calls on station lines are indicated by line-magnetic signals. Incoming calls on trunk circuits and magneto lines are

indicated by line-drop signals. These signals appear along the top of the switchboard above the key levers associated with the calling station or trunk.

(1) All incoming calls are answered by throwing one of the trunk or station key levers in the same vertical column with the operated drop or signal. This process connects the calling station to a connecting circuit. It is necessary that an idle connecting circuit be chosen, that is, that there be no other key lever in the horizontal row already thrown in the same direction. After connection to an idle connecting circuit, the attendant's talking key lever at the right end of the horizontal row corresponding to the trunk or station key lever is thrown in the same direction, permitting the attendant to talk to the party originating the call.

c. Establishing Connection to Called Party.—(1) To make an outgoing call at the request of a station user, the attendant throws the key lever of the station or trunk desired which is located in the same horizontal row as the station and talking key levers previously operated. The key lever is thrown in the same direction as that of the calling party in order to connect them to the same connecting circuit.

(2) To call another local station line the attendant then throws the ringing key lever of the desired station downwards to ring the station and notify the called party that he is wanted. The ringing key levers are in the bottom horizontal row. When the called party answers, the attendant throws his talking key lever to normal to disconnect his telephone circuit from the call.

(a) It is necessary that the attendant restore the attendant's key lever to normal before he hangs up his handset in order to prevent an unpleasant jarring disturbance from being heard in the receivers of the connected stations.

(b) If connecting circuit E is being used to put through the call, it will be necessary to ring the called station before bridging it across the connecting circuit. This is done by operating the bottom key lever in the vertical column associated with the called station downwards and then, after allowing time for the phone to ring, throwing it to the upwards position to make the connection.

(3) In calling a common-battery manual central office, the throwing of the trunk key lever signals the distant operator who completes the call in accordance with commercial practice. The attendant then disconnects his handset from the call by throwing the talking key lever to normal.

(4) To call a magneto central office of another Signal Corps switchboard, the attendant repeats the procedure for calling a local station line except for using the trunk key levers instead of the station key levers.

(5) In calling a common-battery dial central office, the attendant completes the call in the same manner as to a manual central office. The operation of the

trunk key lever, however, results in dial tone being heard instead of an operator. Upon hearing dial tone, the attendant throws the calling-station key lever to normal to remove the station bridge from across the lines and then dials the number of the desired station. Upon completion of dialing, the attendant reconnects the calling party to the connecting circuit. When the connection is completed, the attendant disconnects his handset from the lines by throwing his talking key lever to normal. If the calling station is equipped with a dial, the attendant may disconnect his own handset and allow the calling party to dial.

d. Supervision on Disconnecting.—(1) Supervision on disconnecting is provided by means of magnetic signals associated with each connecting path and placed at the left end of the horizontal row. These signals are controlled by the last station to disconnect and indicate the ending of the call. Upon seeing the supervisory signal, the attendant returns all key levers to normal in the horizontal row in which the signal appears.

(2) During dialing by the attendant, a supervisory signal may flash. The supervisory signal will also function on a call from a common-battery office, when both the holding key lever and a station key lever are thrown, until the called station answers. Under these conditions no action need be taken when seeing the supervisory signal.

e. Holding a Common-Battery Trunk Connection.—Holding on trunk connections from a common-battery office to a station which has not answered is done by means of the attendant's telephone circuit or if it is necessary for the attendant to disconnect the telephone circuit, by throwing a holding key lever. The holding key lever must be thrown downwards before the attendant's talking key lever is thrown to normal in order to hold the connection to the central office. The holding key lever takes the place of the ringing key lever which is not needed in the common-battery central office trunk. If the central office operator rings back on a connection, the station bell will ring provided the key levers associated with the trunk and the station are thrown. The called station may also be rung by the attendant who can throw the ringing key lever downwards.

f. Auxiliary Buzzer and Lamp Signals.—Auxiliary signals are provided by either a pilot lamp or a buzzer depending on the position of the BUZ-LAMP key knob. Whenever a trunk drop, a line signal, or a supervisory signal is operated either the pilot light or the buzzer will operate. These signals are disconnected when the attendant operates a talking key lever.

g. Special Circuits.—Telephone circuits are provided for the controller, liaison officer, and radio operator and connect to the switchboard by means of trunk keys for the last two and a station key for the first named. The throwing upwards

of the top trunk key levers of ringdown trunks nos. 3 and 4 connects the liaison officer's and radio operator's telephone circuits directly to their respective ringdown trunks. The controller and liaison officer's telephone circuits are terminated in two jacks, one arranged for both transmitting and receiving, and the other for receiving only. The radio operator's telephone circuit provides for connection of four transmitting and receiving jacks and three receiving jacks. The controller's telephone circuit is normally connected to the V.H.F. equipment. It can be disconnected from the V.H.F. equipment and connected directly to the first station line by means of a transfer switch. Here the controller's telephone circuit may be connected to the other station lines or trunks just like any other station line except that throwing the top key upwards bridges the controller's circuit across the liaison officer's telephone circuit. Signaling is not provided in either direction for these three telephone circuits. The operation of key levers to connect the liaison officer's and radio operator's telephone circuits to the ringdown trunks and the operation of the key lever to bridge the controller's telephone circuit across the lines of the liaison officer's telephone circuit do not prevent connecting circuit A from being used by the other stations and trunks.

h. Ringing Supply.—Ringing current is normally obtained from a static ringing generator and is connected to the stations by operation of the associated ringing key levers when the RINGING key knob is on KEY. In case of failure of the ringing supply, the hand generator in the switchboard may be used to supply ringing current. When using the hand generator the RINGING key knob must be turned to HAND.

SECTION III

DETAILED FUNCTIONING OF PARTS

6. SWITCHBOARD BD-116-B.

a. This switchboard consists of a table-mounted cabinet housing standard telephone apparatus arranged for army use.

b. In subsequent discussions and in the manufacturer's drawings furnished for this switchboard, frequent reference is made to terms commonly used in telephone practice.

7. EQUIPMENT LAYOUT.

a. The front equipment layout is shown in figure 2 and the rear of the switchboard in figure 15. The front contains the necessary keys and signals for eleven station-line circuits, one line to the controller, one common-battery trunk, four magneto line or trunk circuits, one line to the liaison officer, one attendant's telephone circuit, the signaling and ringing circuits, and five connecting circuits. All the relay, coil, and condenser equipment associated with these circuits is mounted in the rear together with the terminal strips for connecting the cabling and wiring to points outside the switchboard.

b. The various circuits were designed for use in a 24-volt nonmultiple switchboard. A detailed description of the circuit operations is contained in the following paragraphs.

8. STATION LINE CIRCUIT (See Fig. 5).

a. This circuit is for use with telephones that are arranged to operate with a common-battery switchboard. The operation of the station-line circuit is as follows:

(1) When a circuit is completed through a station-line telephone by removing the receiver from the hook, current flows from the battery through relay T to the station line magnetic signal. From the signal it flows through the connecting circuit switches, through the station phone, and back through the connecting circuit switches to ground at connecting circuit A. This causes the line magnetic signal to operate, signaling the attendant. The battery supply for the signal is furnished through the ringing and buzzer circuit to provide for an auxiliary visual or audible signal.

(2) Throwing of one of the station key levers associated with the calling line to position A, B, C, D, or E opens the circuit to the line signal which re-

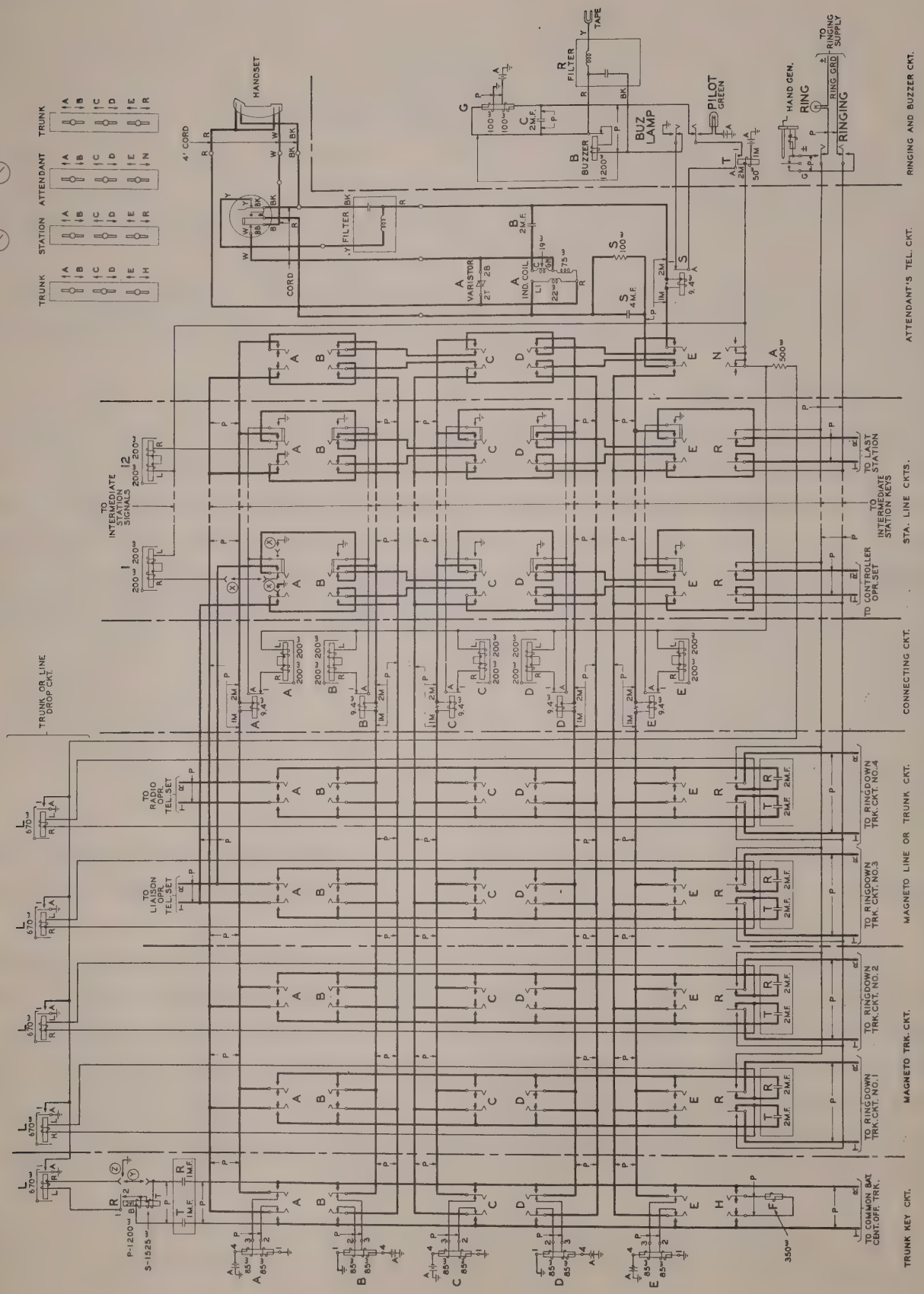


Figure 5 - Schematic Circuit Diagram, Switchboard

leases. The throwing of the station key lever closes ground to the supervisory signal of the same designation through the back contacts of the associated supervisory relay A, B, C, D, or E. The attendant answers by throwing the talking key lever of the same designation in the attendant's telephone circuit. This closes a talking path from the station to the telephone set. Talking battery is supplied from the 54D retardation coil of the same designation as the operated key. This operates the supervisory relay in the associated connecting circuit which prevents the operation of the line supervisory signal as long as any station line of the telephone circuit is connected. In the event that the station telephone is a Telephone EE8, talking battery for it is supplied at the telephone, but this has no effect on the circuit operation. To extend the call to another station the attendant throws the station key lever associated with the desired station to the same position as the thrown talking and station key levers. This connects the talking path already established between the attendant and the calling station through to the called station. The attendant then throws the R ringing key lever of the called station which connects 20-cycle ringing current from the ringing supply to the line. When the called station answers, the attendant restores the talking key lever to normal, thus disconnecting his telephone set. Supervision on disconnect is controlled by the last station to disconnect since the supervisory relay is held from both parties. When the last party disconnects, the supervisory relay releases and closes ground from the operated station keys to the supervisory signal of the connecting circuit in use. Throwing of both the calling and called station key levers to normal removes this ground and the supervisory signal is restored to normal. The station line circuits may be connected to the following types of equipment or circuits:

Telephone EE8 (with screw switch turned to CB)
Commercial common-battery telephone
Controller's telephone circuit (see par. 12a(1))

9. TRUNK KEY CIRCUIT (See Fig. 5).

a. This circuit provides for 2-way service between the Switchboard BD-116-B and a dial (automatic) or manual common-battery central office where connection is made with a standard subscribers' line circuit.

(1) Outgoing Calls to Manual Central Office.—The operation of the calling station line circuit is the same as described in paragraph 8 up to the point where the attendant answers. For the central office call, the attendant throws the trunk key lever of the same designation as the calling station and attendant's telephone key levers previously operated. The throwing of this key lever removes the local battery supplied by the 54D retardation coil from the circuit thus releasing the supervisory relay and operating the supervisory signal. It also closes a talking path through to the central office, where the line lamp signal is lighted by a cir-

cuit from battery at the central office, through a line relay through the calling station to ground. The call is completed the same as a regular central office subscriber's call. Battery and ground from the line relay at the central office may or may not operate the supervisory relay and release the supervisory signal in the switchboard depending on the resistance of the line relay. When the central office operator answers, talking battery is supplied over the loop, and this will release the supervisory signal if it is still operated. Since the supervisory relay is held operated from the central office battery over the station bridge, the station may flash the supervisory signal at the switchboard as well as the supervisory lamp at the central office and will operate both at disconnection.

(2) Outgoing Calls to Dial (Automatic) Central Office.—These calls are handled the same as those to manual central offices up to the point where connection is made to the central office. When the talking path is closed through to a dial office, dial tone is sent back as an indication that the dial equipment is ready to receive dial pulses. Since these work on the principle of intermittent opening and closing of the circuit, the attendant must throw the calling station key lever to normal in order to remove the station bridge from the path to the dial equipment. The attendant then dials the desired number, and the call is completed in the same manner as for a regular dial subscriber. Operation of the supervisory signal is the same as for the manual call except that it may flash during dialing. If the local calling station is equipped with a dial, the attendant may disconnect his handset and allow the calling party to dial.

(3) Incoming Calls from Central Offices.—On an incoming call relay R, which is bridged across the trunk, operates on the ringing current and connects the drop L from the midpoint between the primary and secondary windings of relay R to ground. The drop operates on the ringing current through one winding of the R relay. It is shunted by the other winding, the associated condenser, and the side of the line connected to ringing-current return at the central office. The attendant throws one of the trunk key levers A, B, C, D, or E and completes the call to the desired station in the same manner as a station-to-station call except that the trunk drop must be restored to normal manually. However, if it is necessary for the attendant to disconnect his telephone circuit from a trunk connection which has not been extended to a station, the central office connection must be held by throwing the hold key lever H which bridges the retard coil F across the trunk. The hold key lever must be thrown downward before the attendant's telephone key lever is thrown to normal; when the attendant again listens in on the connection, the hold key lever must not be released until after the attendant's key lever is thrown. When the attendant's key lever is thrown to normal, the supervisory signal in the connecting circuit will operate if the station key lever is thrown and will release when the

station comes back on the connection. When the hold key lever is operated to hold a connection which has been set up on connecting circuit E, the path to the central office is opened for the period required to switch the connection from position E to the hold position. In the case of a manual office connection, this open period will flash the central office operator's supervisory lamp, but in the case of an outgoing call to a dial office it may release the connection. Connecting path E, therefore, is not recommended for use with the common battery trunk circuit.

(4) The trunk key circuit may be connected to the following types of circuits:

(a) Commercial common-battery manual subscribers' line circuit.

(b) Commercial common-battery dial subscribers' line circuit.

(c) Commercial manual long line circuit

10. MAGNETO TRUNK OR LINE CIRCUIT (See Fig. 5).

a. These circuits provide for 2-way service between Switchboard BD-116-B and a magneto central office, another army switchboard and a local battery telephone set.

(1) Outgoing calls are made in the same way as station-to-station calls except that the proper trunk key lever instead of called station key lever is operated. The circuit operations for this type of call are explained in paragraph 8.

(2) Incoming calls are indicated by the operation of the line drop due to ringing current sent out from the originating point. This drop must be restored to normal manually, otherwise the call is completed in the same manner as a station-to-station call. (See par. 8.)

(3) The magneto trunk or line circuit may be connected to the following equipment or types of circuits:

(a) Telephone EE8 (with screw switch turned to LB).

(b) 2-way trunk circuit to magneto central office.

(c) 2-way trunk circuit to other army switchboard.

11. RINGING AND BUZZER CIRCUIT (See Fig. 5).

a. The ringing supply from the static generator is connected to the ringing keys in the switchboard through the contacts of the key RINGING when it is in the KEY position. If for any reason this ringing supply fails, emergency ringing is provided by turning the RINGING key knob to HAND position, throwing the RINGING key lever of the desired station or magneto trunk and cranking the hand-generator handle. Thus the emergency ringing circuit is closed through the make contacts of the RINGING key.

b. The buzzer circuit provides an auxiliary visual or audible signal to operate as desired whenever a line or supervisory signal operates. With the key knob BUZ-LAMP turned to the LAMP position the pilot lamp will light, and with the key knob turned to the BUZ position the buzzer will function. The path for operation of these is from ground through an operated trunk drop, line signal, or supervisory signal, through the key position N to the battery on relay T which operates. The closure of the contacts of this relay closes a circuit through the contacts of relay S which causes one of the auxiliary signals to function. When the attendant throws the talking key lever, relay S operates from the talking battery and silences the buzzer or extinguishes the lamp. The filter R connected to the buzzer prevents radio-frequency interference.

12. CONTROLLER AND LIAISON OFFICER'S CIRCUITS (See Fig. 6).

a. Each circuit provides for connection to the switchboard of two telephone sets with one arranged for both talking and listening and the other arranged for

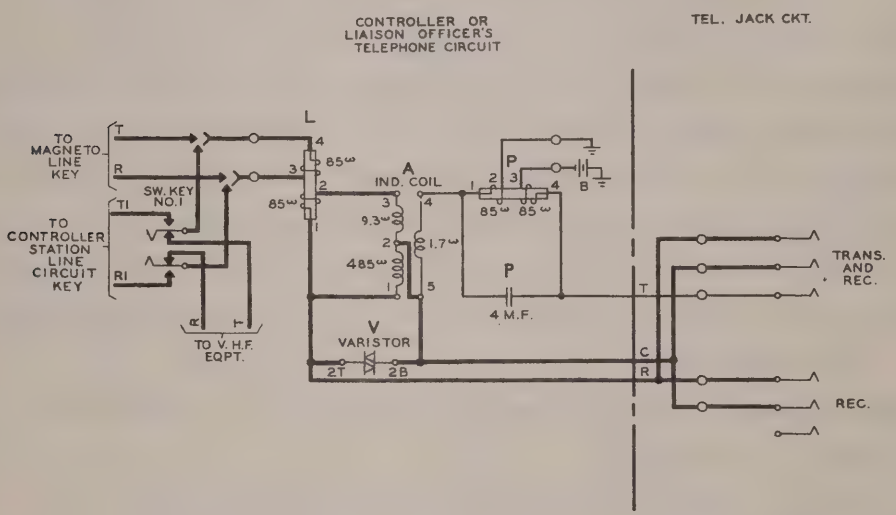


Figure 6 - Schematic Circuit Diagram, Controller and Liaison Officer's Telephone Circuits

listening only. These telephone circuits are equipped with local talking battery but are inductively coupled to the switchboard through the retardation coil L to permit connection to either local or common-battery stations. The circuits are connected to the switchboard as follows:

(1) The controller's telephone circuit is connected to a transfer key through the break contacts to the V.H.F. set and through the make contacts to a station-line circuit on which the line magnetic signal has been made inoperative. The contacts of key position A on this particular line circuit are not multiplied to

the other station-line keys but are connected to the trunk key to which the liaison officer is connected. Thus by operation of the controller's station key lever to position A, he is connected directly across the liaison officer's telephone circuit. The remainder of the key positions of the controller's line circuit are multiplied to the other station lines so that connection to the latter or to the trunks is made in the same manner as an ordinary station line. No method of signaling between the controller and the switchboard is provided, but the supervisory signals in the connecting circuits will operate in the usual manner when the station keys are thrown to any position except A.

(2) The liaison officer's telephone circuit is the same as the controller's except that it is connected directly to position A of the trunk key lever of magneto line or trunk circuit no. 3. Throwing the key lever to the A position connects the liaison officer directly to the magneto line or trunk connected to the key. Throwing of the trunk key levers to position B, C, D, or E permits the addition of station-line or magneto trunk circuits as desired to the connection.

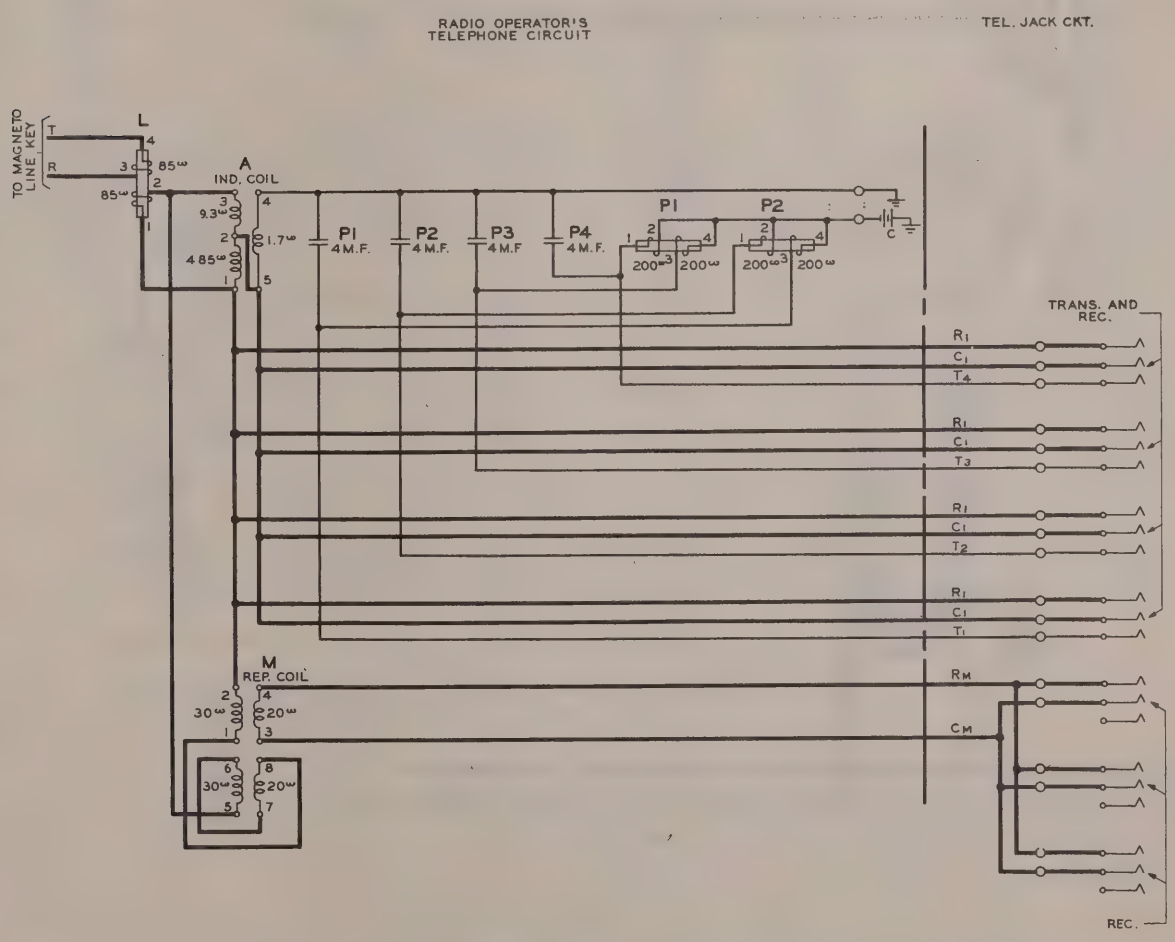


Figure 7 - Schematic Circuit Diagram, Radio Operator's Telephone Circuit

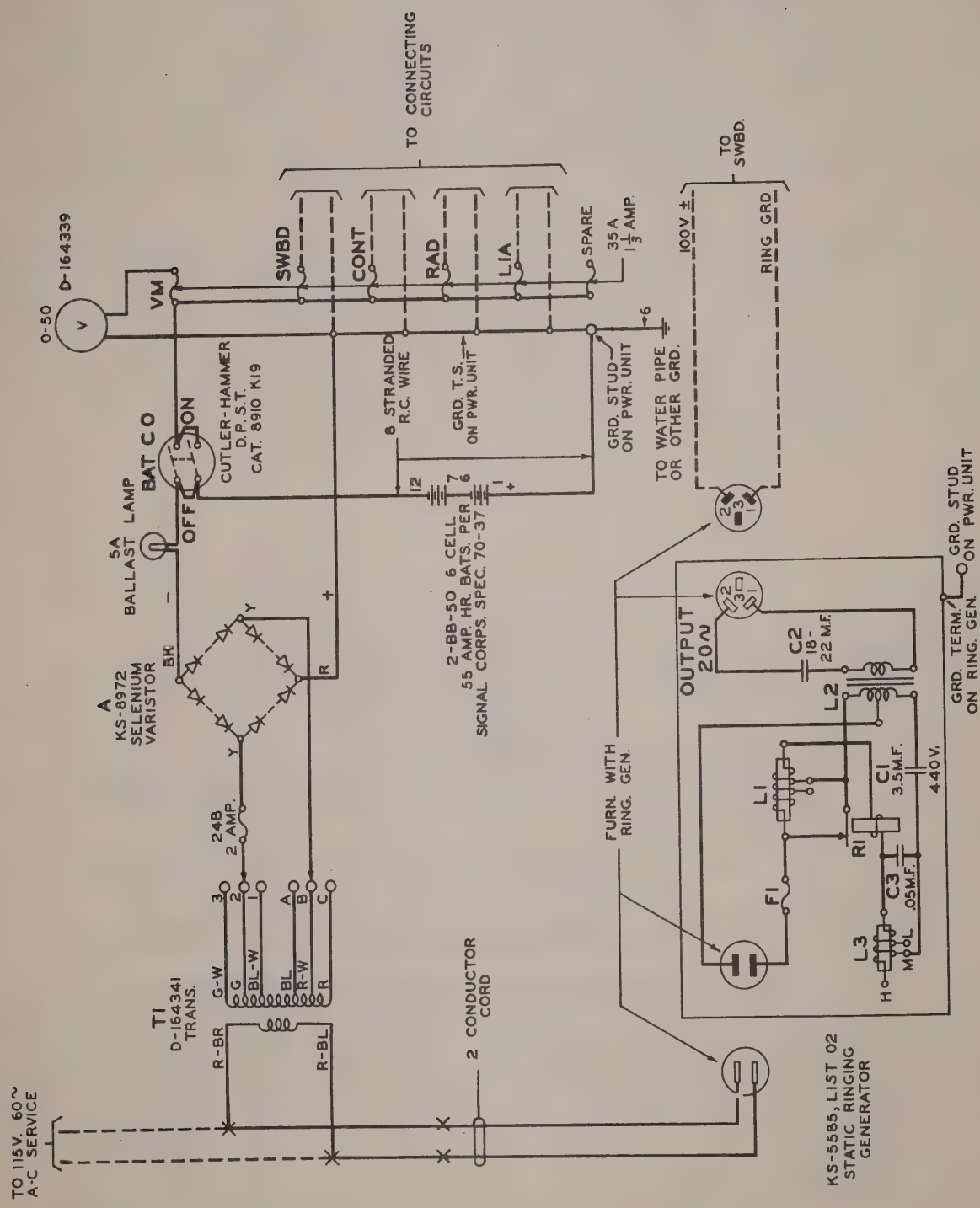


Figure 8 - Power Circuit Diagram

13. RADIO OPERATOR'S TELEPHONE CIRCUIT (See Fig. 7).

a. This circuit functions the same as the liaison officer's circuit except for the number of telephone sets connected to it and its point of connection to the switchboard. This circuit is arranged for use with four talking and receiving telephone sets and three receiving-only sets and is connected to the A position of the trunk key lever of magneto line or trunk circuit no. 4. Throwing this key lever connects the radio operator's telephone circuit to ringdown trunk circuit no. 4, and throwing the other key levers to position B, C, D, or E connects to a station line as with the liaison officer.

14. POWER EQUIPMENT.

a. Power Equipment PE-166 housed in a 3-tier cabinet is included with Telephone Switchboard BD-116-B and is discussed in paragraph 1e. (See figs 8 and 17.)

b. Battery Supply.—(1) The selenium rectifier A (refer to power circuit drawing, fig. 8) is rated at 0.8 amperes at 24 volts. The 55-ampere hour battery acts as a filter, will care for peak loads, and provides a reserve in case of power failure.

(2) 115-volt, 60-cycle, a-c power service is stepped down through transformer T1 and rectified by the selenium varistor A. The resulting direct current is supplied through a ballast lamp to the battery and the load. The coarse taps A, B, and C on the secondary of transformer T1 allow changes of approximately 3.5 volts in the voltage applied to varistor A and the fine taps 1, 2, and 3 allow changes of approximately 1.2 volts in the voltage applied to varistor A. Proper selection of these taps on the associated terminal strip will give the desired output voltages from the varistor. The voltage actually applied to the battery depends on the current through the ballast lamp and this current depends on the load and the state of charge of the battery. The ballast lamp regulates the output current from the varistor since its resistance increases rapidly with currents above 0.8 ampere and will limit the output to slightly over 1.0 ampere maximum.

c. Ringing Supply.—(1) The static ringing generator converts 60-cycle current to 20-cycle current.

(2) When 115-volt, 60-cycle current is connected to this generator, relay R1 operates, opening its contact, which changes the circuit constants and attempts to start 20-cycle oscillations. If the 20-cycle oscillations do not start, the relay releases momentarily, reoperates, and again attempts to start 20-cycle oscillation. Usually the circuit will start oscillating at 20 cycles with two or

three operations of the relay. When 20-cycle operations start they will hold relay R1 operated, keeping the circuit constants favorable for this frequency. The 20-cycle oscillations are sustained by the 60-cycle input.

15. WORKING LIMITS.

a. The range on station-to-station calls with a minimum insulation resistance of 20,000 ohms for one station and 15,300 ohms for all staticns combined is as shown in the following table. To determine the maximum conductor loops, deduct the resistance of the telephone set used. (For Telephone Set EE-8, deduct 100 ohms.)

Battery Voltage	Extension Circuit Loop
20	520 ohms
22	620 ohms
24	720 ohms

b. The range of stations to common-battery manual or dial central offices is as follows:

Type of Office	Trunk Signaling at 20 Cycles	
	72-volt Minimum	75-volt Minimum
Manual, Panel, or Crossbar		
Maximum Conductor Loop	1,000 ohms	1,200 ohms
Minimum Insulation Resistance	20,000 ohms	20,000 ohms
Step-by-Step		
Maximum Conductor Loop	1,000 ohms	1,200 ohms
Minimum Insulation Resistance	30,000 ohms	30,000 ohms

The over-all ranges on central office to common-battery station connections are dependent on the working limits of the central office. The total range, that is, the sum of the trunk and station loop, shall not exceed the conductor loop limit of the central office.

c. The ringing ranges of the ringdown trunks connecting to the magneto line and trunk circuits are as follows:

No. and Code of Ringers*	Ringing Supply: 16 or 20 Cycle 70-volt Minimum	Ringing Supply: Switchboard Hand Generator
0	2800 ohms	3000 ohms
1 - 38A or MC131	2600 ohms	2900 ohms
3 - 38A or MC131	2100 ohms	2400 ohms
5 - 38A or MC131	1700 ohms	1800 ohms
8 - 38A or MC131	700 ohms	1000 ohms
1 - 38B	2800 ohms	3000 ohms
5 - 38B	2600 ohms	2800 ohms
10 - 38B	1900 ohms	2200 ohms
15 - 38B	1200 ohms	1600 ohms
20 - 38B	900 ohms	1000 ohms

*The MC131 ringer is part of the Telephone Set EE-8. The 38A and 38B code is Western Electric Company.

SECTION IV

MAINTENANCE

16. MAINTENANCE.

a. Care.—The greatest single factor in trouble-free operation is careful handling of the equipment while unpacking, installing, and operating.

b. Inspection.—The various component parts of the switchboard, power plant, and protector and terminal box shall be given a thorough inspection once a month or more often where climatic conditions warrant. This inspection should include the examination of switchboard trunk drops, station line signals, supervising signals and keys, power-plant fuses, and protector-box heat coils, and protector blocks.

c. Dust and Dirt.—Due to the fact that the failure of a circuit to function properly is often traced to dirty relay and key contacts or dirty or gummy parts, it is essential that contacts and parts be kept clean. It is important, therefore, that the inside of relay covers and other apparatus covers should be kept clean and that they should not be left off longer than absolutely necessary. Also, switchboard cover, power-plant cover, and protector and terminal cover should not be kept open unnecessarily. The monthly inspection should include a careful examination of all contacts that are open to the air for dust or other foreign particles.

17. LINE TEST EQUIPMENT.

a. A portable Test Cabinet EE65 containing telephone equipment is furnished. All the ringing and talking tests that can be made with an ordinary local-battery local telephone can be made with this test set. In addition several other telephone line tests can be made as follows: (See Signal Corps School Pamphlet No. 2 for detail of tests.)

(1) Test for continuity of a metallic circuit.

(2) Test to determine value of an unknown resistance.

(3) Test for continuity of a grounded line.

(4) Test for ground on a metallic line.

(5) Test for a short.

(6) Tests for crosses with a line carrying a current.

(7) Test for crosses with other lines.

(8) Test for capacity.

18. MISCELLANEOUS EQUIPMENT.

a. In addition to the equipment discussed in the foregoing paragraphs, the following equipment and tools are supplied for operation and maintenance of the telephone exchange.

(1) One set of tools in tool roll.

(2) One ledger book.

(3) One hydrometer battery tester.

19. LOCATING TROUBLE, CIRCUIT OPERATION TESTS.

WARNING: THE PERSONNEL MAKING THE CIRCUIT OPERATION TESTS MUST BE THOROUGHLY FAMILIAR WITH THE OPERATION OF THE SWITCHBOARD AS GIVEN IN PARAGRAPH 5.

a. Generator Feeder.—(1) To test for the presence of ringing current, ring the bell of a nearby station by pressing the bottom key lever downwards in the column associated with the station.

(2) To test for the proper operation of hand generator and ringing key knob turn the ringing knob to the HAND position. Throw the ringing key lever associated with the nearby station and turn the hand-generator handle. The bell at the station should ring. Restore the RINGING key lever to normal and turn the ringing knob to the KEY position.

(3) To test for reversed generator feeder, connect one clip of the test receiver to the terminal SWBD GRD of the terminal strip BAT GRD. Connect the other clip to the terminal RING± of the terminal strip across the top of the unit which is connected to the switchboard side of the resistance lamp RING. If the generator feeder is correctly connected, ringing current will be heard in the test receiver and the resistance lamp RING will light.

b. Battery Feeder.—(1) To test for the presence of battery, momentarily throw a connecting key lever of an idle or spare station to an operated position on an idle connecting circuit. Observe that the supervisory signal operates.

(2) To test for reversed battery feeder:

(a) Determine that the generator feeder is properly connected.

(b) With all the station connecting key levers in normal position, connect one clip of the test receiver to the terminal RING G of the terminal strip (generator feeder) and touch the other test clip to the terminal R on the terminal strip of a station line. The station line signal will function if the battery feeder is properly connected.

c. Test of the Supervisory Signal in Connection with Each Station Connecting Key.—Throw the station connecting key levers of the station line under test to each

position. The supervisory signal associated with each position should function when the key lever is thrown and should restore to normal when the key lever is restored to normal.

d. Test of Station Line Signal and the Continuity of the Circuit Through the Station Connecting Keys.—(1) Connect the test receiver across the station line terminals T and R at the terminal strip. The line signal should function.

(2) Throw the station connecting key levers of the station line to each position. The line signal should restore to normal when each key lever is thrown. The associated supervisory signal should not function because of the test receiver bridged across the station lines.

e. Test of Station Ringing Keys.—With the test receiver still connected across the station line terminals T and R, throw the station ringing key lever. Note that ringing current is heard in the test receiver. Disconnect the test receiver.

Note: When making the above test, the bell at the station may ring. If somebody answers the phone, advise him that the line is being tested and request him to disconnect.

f. Test of Break Contacts of Station and Trunk Keys.—(1) Throw the bottom key lever of the attendant's telephone circuit upward. Connect one clip of the test receiver to the cord fastener Y of the attendant's telephone set. Tap the other clip of the test receiver to the terminal R of the station line under test, and slowly throw the top station connecting key lever to its upward position. As the key lever is slowly moved, a point should be reached where the terminal R will test clear, as indicated by no clicks in the test receiver. Repeat the test on the terminal T of the station line under test. This indicates that battery and ground from the station line circuit are disconnected from the station line as the key is thrown.

(2) Throw the top station connecting key lever to its upward position and, in continuation of the preceding test (par. 19f(1)), throw in succession each top trunk key lever to its upward position while tapping the terminals of the station line under test. As each trunk is slowly thrown, a point should be reached where the terminals T and R will again test clear as indicated by no clicks in the test receiver. This indicates that local battery and ground are disconnected as the trunk key is operated. Similarly test the other positions of the trunk and station connecting keys.

Note: When testing the upward position of the bottom key levers, the attendant's telephone key lever associated with this position should be restored to normal position and another attendant's telephone key lever thrown.

(3) The test of the trunk keys, paragraph 19f(1), need only be conducted from the terminals of one station line and need not be repeated while testing the station-connecting keys associated with other station lines.

g. Supervisory Relay Test.—Throw a station connecting key lever of a spare or idle station line to the position associated with the supervisory relay under test. The supervisory signal should function. Throw the attendant's telephone key lever to the same position as the thrown station connecting key lever. The supervisory signal should stop. Throw that attendant's telephone key lever on and off several times and observe that the supervisory signal flashes. Restore all key levers to normal.

h. Testing of Attendant's Telephone Set and Dial Circuit.—(1) Throw an attendant's telephone key lever and remove the attendant's handset from the hook. Note the sidetone in the receiver. Shake and slightly twist the desk stand and receiver cords to test for cutout or noise.

(2) To test the dial circuit make the following test. Connect the attendant's telephone set to a dial central office trunk and operate the dial to call the central office operator or a test number. Note that the trunk drop does not function and that excessive clicks are not heard in the receiver while dialing.

i. Test of Trunk Drop and Trunk-Drop Buzzer Contacts.—Obtain a ring on the trunk from another switchboard. The trunk drop should operate on the incoming call. Turn the BUZ-LAMP key knob to BUZ and note that the buzzer operates. Restore the drop shutter to normal. The buzzer should stop.

j. Trunk Polarity Test.—Connect one clip of the test receiver to the (battery feeder) terminal SWBD GRD of the terminal strip and touch the other clip alternately to the line terminals of each working trunk. If a louder click is received on the terminal R of the trunk than on the terminal T, the trunk is properly connected.

k. Trunk Holding and Talking Test.—With one clip of the test receiver still connected to terminal SWBD GRD, connect the other clip to the terminal T of the trunk under test. Throw and restore to normal the trunk holding key lever and note that a click is heard in the test receiver. Restore the equipment to normal and make a talking test with another switchboard from each position of the trunk key lever.

l. Battery Cutoff and Auxiliary Signal Circuit.—(1) Turn the BUZ-LAMP key knob to BUZ. Cause a trunk drop to function manually. The buzzer should operate. Throw an attendant's telephone key lever. The buzzer should stop. Restore to normal the attendant's telephone key lever. The buzzer should operate. Turn the BUZ-LAMP knob to LAMP. The buzzer should stop and the lamp should light. Restore the trunk drop to normal. Repeat this procedure to test the lamp.

(2) With all the station connecting key levers normal and the BUZ-LAMP key knob turned to BUZ, connect the test receiver across the terminals of a station line. The buzzer should operate. Turn the BUZ-LAMP key knob to LAMP. The buzzer should stop and lamp should light. The line magnetic signal should operate in both cases.

m. Dial Tone Tests.—When the first trunk is connected to a dial central office, test for dial tone by throwing a trunk connecting key lever. Then throw an attendant's telephone key lever to the corresponding position and note the presence of dial tone in the receiver of the attendant's handset.

20. REPAIRS.

a. Repairs other than the following will not be attempted by the operating personnel unless specifically authorized by the Signal Corps general catalogue.

b. Contacts.—(1) General Cleaning.—If an excessive amount of dust has collected on or adjacent to the contact portion of the key, relay, etc., remove it with a Western Electric Company KS-2993 type brush. Protect adjacent apparatus while performing this operation.

(2) Burnishing.—When necessary to clean contacts, burnish them using a clean blade of a Western Electric Company No. 265 type burnisher (fig. 9). It is very important to keep clean the blades of the contact burnisher and any thickness gauges which are used on the contacts. These should be wiped off frequently with a clean dry cloth before being placed against each contact and frequently wiped with a clean cloth dampened with carbon tetrachloride. In burnishing normally-open contacts of a key or relay, place the blade of the burnisher between the contacts, press them together with a Western Electric Company KS-6320 orange stick, and operate the relay manually giving a slight pressure against the blade of the burnisher and at the same time moving the blade back and forth. The desired result is usually obtained by rubbing the burnisher between the contacts two or three times. In the case of normally-closed contacts, the tension of the springs themselves will usually furnish sufficient pressure against the burnisher. On springs having heavy tension, lift one of the springs away sufficiently to insert the burnisher. To obtain sufficient tension on voltmeter and milliammeter relays, operate the relays electrically to close the contacts as they are being burnished.

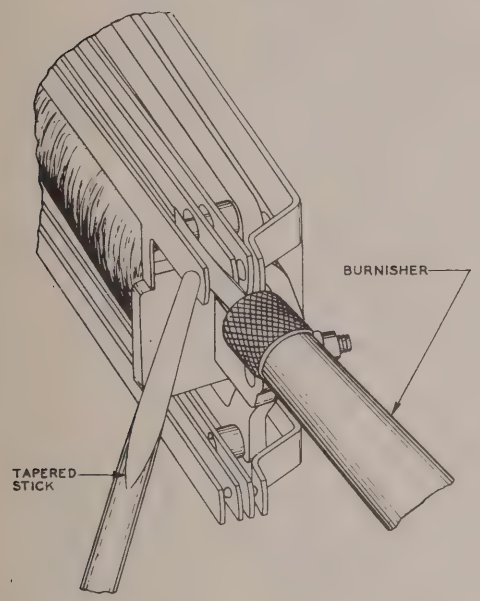


Figure 9 - Burnishing Relay Contacts

(3) Flushing.—When unable to clean contact trouble by burnishing only, clean and flush the contacts in the following manner: Dip the flat end of a clean toothpick into the carbon tetrachloride to a depth of about 1/2 inch and deposit the liquid on the contacts (held slightly separated) without rubbing. Then dip the flat

end of another toothpick in the carbon tetrachloride and again deposit the liquid on the contact without rubbing to flush away the dirt which has been loosened by the first application. Take care to keep the carbon tetrachloride from coming in contact with the spoolheads or insulators. When the contacts are thoroughly dry, burnish them to insure that no deposit or residue from the solution or any foreign material remains on the contact.

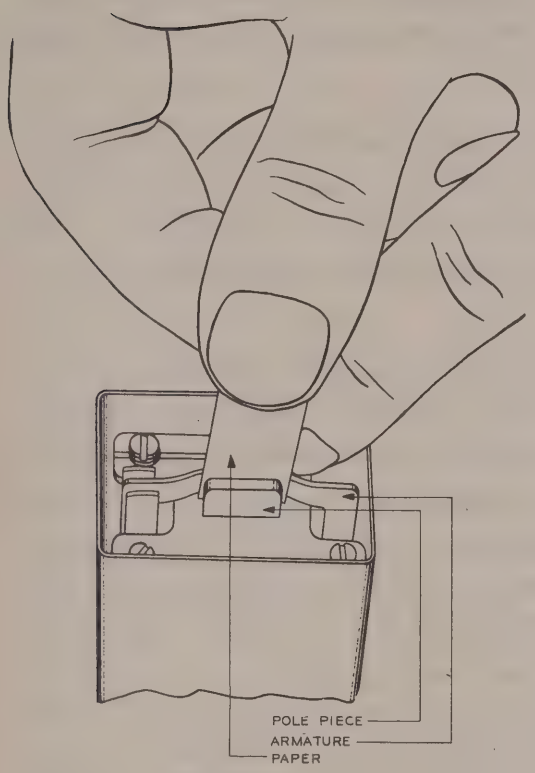


Figure 10 - Cleaning Relay Armature

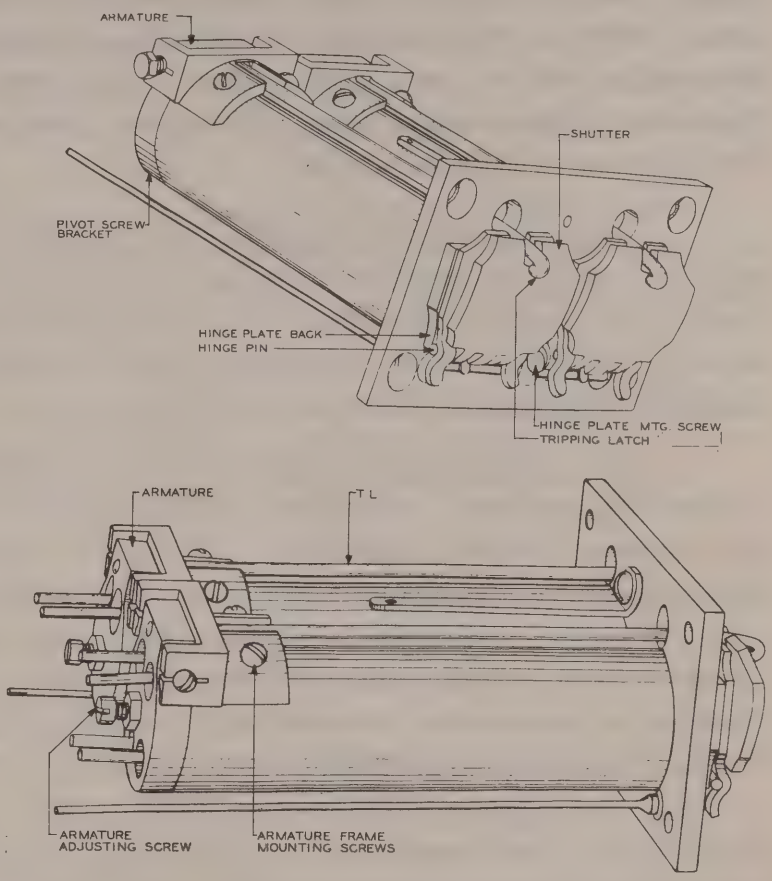


Figure 11 - Drops, Two Views

c. Armatures.—(1) Cleaning Sticky Armature (See Fig. 10).—Insert Western Electric Company KS-7188 paper or approved equivalent between the armature and the core of the relay. Press the armature manually toward the core so that a slight pressure exists between the strip of paper and the part being cleaned and then withdraw the paper. Repeat the operation until the paper shows no evidence of dirt when it is removed. Use a clean piece of paper for each operation.

(2) The armature and the armature backstop may be cleaned as outlined in paragraph 20c(1) above.

d. Drops (See Fig. 11).—(1) Cleaning.—(a) Tripping Latch and Top Notches of Shutter and Shutter Hinge Plate.—To clean only the tripping latch and the top

notches of the shutter and shutter hinge plate, apply a clean piece of cloth saturated with carbon tetrachloride and then wipe dry with a clean cloth. This can be done without dismantling the parts.

(b) Entire Shutter End of Drop.—If only the shutter end of the drop appears sticky and needs cleaning, proceed as follows: Remove the shutter hinge plate mounting screws with a 3-inch screwdriver. Remove the shutter, shutter hinge plate, and hinge pin. Clean the parts with a clean piece of Western Electric Company D-98063 cloth saturated with chemically pure carbon tetrachloride and dry them thoroughly with a clean cloth. Confine the carbon tetrachloride to the bearing surfaces and latch slots. Mount the shutter plate on the hinge plate back and tighten the mounting screws securely.

(c) Armature Bearings and Pivot Screws.—If the armature bearings appears sticky, clean the armature bearings and pivot screws with a small amount of chemically pure carbon tetrachloride. Apply the tetrachloride with a toothpick. Take care to prevent it from coming in contact with the parts of the drop other than the armature bearings, or with adjacent apparatus.

(d) Armature Adjusting Screw.—To clean only the armature adjusting screw, proceed as follows: Insert the Western Electric Company KS-6854 screwdriver through the Western Electric Company No. 220 socket wrench and loosen the nut by turning it in a counterclockwise direction with the wrench while holding the armature adjusting screw with the screwdriver. Remove the armature adjusting screw from the armature, clean it with a clean piece of Western Electric Company D-98063 cloth saturated with chemically pure carbon tetrachloride and then dry it thoroughly with a clean cloth. Remount the armature adjusting screw in the armature.

(e) Core.—To clean the core, insert a piece of Western Electric Company KS-7187 Bell Seal bond paper or equivalent between the armature and the core bottom. Hold the armature against the paper and then withdraw the paper.

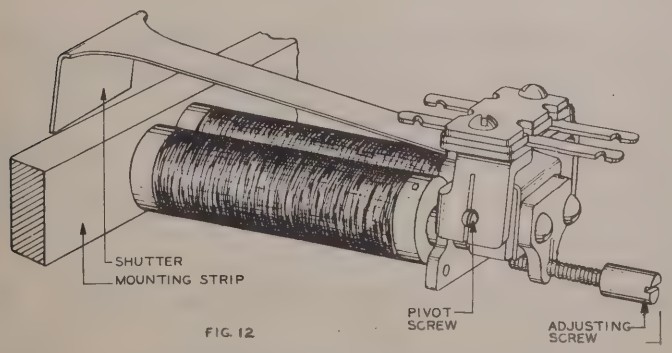


Figure 12 - Signals

e. Signals (See Fig. 12).—If the signal fails to operate satisfactorily, clean the armature bearings with a small amount of chemically pure carbon tetrachloride applied by means of a clean toothpick. Care should be taken to prevent the carbon tetrachloride from coming in contact with parts of the signal other than the armature bearings or with adjacent apparatus.

f. Relay Adjustment.—The circuit requirements shown in figures 13 and 14 give necessary information for making mechanical and electrical adjustments on the various relays. The necessary tools and equipment for making this adjustment are not included as a part of Switchboard BD-116-B. These adjustments, therefore, should not be attempted in the field but should be performed by signal repair companies or higher repair echelons.

g. Cords.—Cords may become defective because of an open circuit in one or more conductors or between any conductor and ground. These defects most frequently occur at the point of attachment of the cord. These points should be examined and where possible, necessary repairs made. In the event that the damage occurs any great distance from either end of the cord, it is normally impossible to make a serviceable permanent repair of the cord. A new cord should be obtained and installed; however, in an emergency, the defective portion of the cord may be cut out and a jumper used to restore the necessary circuits until a new cord can be obtained.

h. Handset or Headsets.—The failure of a handset or headset to operate properly is usually due to a defective cord or plug which may be reparable. However, if the damage is within the phone, a new headset or handset should be secured and the defective unit shipped to the proper agency for repair.

21. POWER PLANT SERVICING.

a. Battery.—(1) Batteries generally will be furnished dry charged. They should be filled with electrolyte, (if electrolyte is furnished separately its specific gravity should be 1.270 at 70F), to a level about 1/2 inch above the separators. After the initial filling the level should be maintained by the periodic addition of distilled water or water approved for storage battery use.

(2) Charge for 40-50 hours with no connected load (BAT CO switch off) and with transformer T1 secondary connections on terminals 3 and C. Connections are made at terminal strip on top tier. This should raise the specific gravity of the electrolyte to 1.275 to 1.290. Take and record a hydrometer reading on a cell selected as a pilot cell.

(3) When switchboard is placed in service, reconnect to a-c power using transformer terminals 2 and B, and adjust charger output by a series of transformer tap changes based on weekly pilot cell hydrometer readings. Moving from C to B or B to A decreases output voltage of the transformer about 3-1/2 volts and changing from 3 to 2 or 2 to 1 decreases voltage about 1.2 volts. Changes in transformer voltage are not reflected immediately in battery voltage due to the delay caused by the battery and ballast lamp. The proper charger output is obtained by reducing voltage until weekly hydrometer readings begin to decline and then raising the voltage one coarse tap that is moving from A to B, B to C, or 1 to 3.

(4) After the charger is adjusted, take hydrometer readings on pilot cell monthly. If one reading is 10 points (.010) below the one before, or if the corrected specific gravity is less than 1.250, raise charger output voltage by one coarse tap if available.

(5) To correct specific gravity readings for temperature, add one point (0.001) for each 3 degrees, that is 1/3 point per degree, above 70F and subtract one point for each 3 degrees below 70F.

(6) If the battery terminals become corroded scrape off the corrosion; wash with a soda solution and put on a light coating of petrolatum.

b. Transformer.—Transformer T1 requires no maintenance. It is mounted on the top shelf of the cabinet and the leads from it are connected to a terminal strip adjacent to the transformer.

c. Static Ringing Generator.—Except for the starting relay and fuse, all parts of the static ringing generator are potted since it is not necessary that they be reached for maintenance or replacement. Relay R1 operates infrequently and should require no attention but should be replaced if failing to operate. Replace fuses if necessary.

[A. G. 062.11 (1/30/43)]

By Order Of The Secretary of War:

G. C. MARSHALL,
Chief of Staff.

Official:
J. A. ULIO,
Major General,
The Adjutant General

Distribution:
X

SECTION V

SUPPLEMENTARY DATA

22. REPLACEABLE PARTS.

a. General.—The reference designations shown in the first column of the table in paragraph 22c(2) correspond to the designations shown on the wiring of the circuits in figures 5, 6, 7, and 8. These designations are also stamped on the apparatus or on the mounting adjacent thereto as shown in figures 18 and 19.

b. List of Manufacturers.

Abbreviation	Name	Address
B and P	Boorum and Pease	Brooklyn, N. Y.
Bry.	Bryant Electric Co.	Bridgeport, Conn.
C.H.	Cutler-Hammer, Inc.	Milwaukee, Wisc.
Conn. T and E	Connecticut Telephone and Electric Co.	Meriden, Conn.
E.S.I.	Electric Soldering Iron Co.	Deep River, Conn.
G.L.	General Lead Battery Co.	Paterson, N. J.
Hubbell	Harvey Hubbell, Inc.	Bridgeport, Conn.
Jenkins	Jenkins Co.	Bridgeport, Conn.
Jones	Howard B. Jones Co.	Chicago, Ill.
Kester	Kester Co.	Chicago, Ill.
Littel	Littelfuse, Inc.	Chicago, Ill.
W.E.Co.	Western Electric Co.	New York, N. Y.
Willard	Willard Storage Battery Co.	Cleveland, Ohio

c. List of Replaceable Parts.

(1) Switchboard BD-116-B.

Reference Symbol	Stock No.	Name of Part	Description	Function	Manufacturer	Mfr. Part Number
B		Buzzer	Operates on direct current or on alternating current; 24v, 16-2/3 cycle, 1200-ohm resistance	Audible Signal	W.E.Co.	4C per D-161879
A		Coil, Induction (Antisidetone)	3-winding, closed-core, shielded coil, d-c resistances, 485 ohms, 9.3 ohms, 1.7 ohms	Controller's and Liaison Officer's Telephone Circuit	"	178A per D-161818
B		Coil, Induction (Antisidetone)	3-winding type d-c resistances, 22 ohms, 75 ohms, 19 ohms	Attendant's Telephone Circuit (Antisidetone type)	"	101A per D-161107
L		Coil, Induction	3-winding, closed-core, antisidetone type in metal can; resistance winding (1-2) -485 ohms, (2-3) 9.3 ohms, (4-5) 1.7 ohms	Controller's and Radio Operator's Telephone Circuit	"	178A per D-162927
A,B,C,D, E		Coil, Retard	Straight core type in metal cylinder 4-7/8"xl-1/2", 2 windings each with 85-ohms, d-c resistance	Switchboard Battery Feed	"	54D per D-41750
F		Coil, Retard	Straight-core type in metal cylinder 3-5/8"xl"; one winding with 350-ohm resistance (direct current)	Central Office Trunk Holding Circuit	"	47H per D-17719
L		Coil, Retard	Closed-core type in metal case 3-3/4"xl-11/16"xl-3/16"; 2 windings each with 85-ohm resistance (direct current)	Controller's and Liaison Officer's Telephone Circuit	"	307P per D-161818
G		Coil, Retard	Same as 47H, 2 windings with 100-ohm resistance each	Ringing and Buzzer Circuit Battery	"	47N per D-17719
P1,P2		Coil, Retard	Closed-core type in metal case 3-3/4"xl-11/16"xl-3/4"; 2 windings each with 200-ohm resistance (direct current)	Radio Operator's Battery Supply	"	307N per D-161818
M		Coil, Repeating	Shell type in oval metal case 4-7/16"x3-1/8"xl-11/16"; 4 windings, 2 with 30 ohms, and 2 with 20-ohm resistance (direct current) impedance ratio, (2-1) (6-5) to (4-3) (8-7), 1.5 to 1	Radio Operator's Telephone Receiving Circuit	"	94F per D-162194
B,C		Condenser	Paper type in metal case 3-1/2"x 1-1/2"xl"; 2.0 minimum, 2.50 maximum μf capacity; operating voltage 200-volt direct current, 180 effective alternating current at 60 cycle	Attendant's Transmitting Circuit Buzzer Filter	"	139A per D-161882

Switchboard BD-116-B (Cont'd)

Reference Symbol	Stock No.	Name of Part	Description	Function	Manufacturer	Mfr. Part Number
P, P1, P2 P3, P4, S		Condenser	Paper type in metal case 3-1/2"x 1-5/8"x1-1/2"; 4 minimum, 5 maximum, μf capacity; operating voltage 200-volt direct current, 180 effective alternating current at 60 cycles	Battery Feed Filter in Controller, and Radio Operator, Transmitting Circuit	W.E.Co.	137A per D-161880
T & R		Condenser	2 paper type in metal case 3-1/2"x 1-5/8"x1-1/2"; each 2.0 minimum 2.5 maximum μf capacity; operating voltages same as 137A type	Magneto Trunk, D-c Blocking	"	137C per D-161880
T & R		Condenser	2 paper type in metal case 3-1/2"x 1-1/2"x1"; each 1.0 minimum, 1.25 maximum μf capacity, operating voltage same as 137A type	Common-Battery Trunk Ringing	"	139C per D-161882
		Cord	5-conductor with tinsel conductors and rubber insulation	Dial Connection	"	D5AB
		Cord	3-conductor same construction as D5AB	Handset	"	H3H, 4 feet long
SPL, SLA		Dial	Standard telephone dial with digits 1-0	Dialing Automatic Central Office	"	5LA per D-16313
L		Drop	One winding shutter-type resistance 670 ohms (direct current) operating current 0.0055 ampere	Trunk Signals	"	56L per D-161895
R		Filter	Special condenser coil circuit	Radio-frequency suppression for buzzer and dial pulses	"	61A
		Generator, Hand	3 bar type with noninductance load of 2660 ohms and armature speed of 1000 rpm, produces 60 volts alternating current: resistance 535 ohms	Emergency Ringing	"	22A per D-163037
		Generator, Crank		Crank	"	P-297449
		Handset	For common-battery station circuits of not more than 3 volts complete with transmitter and receiver	Attendant's Telephone	"	F1AW-3 per D1611

Switchboard BD-116-B (Cont'd)

Reference Symbol	Stock No.	Name of Part	Description	Function	Manufacturer	Mfr. Part Number
Trunk		Key	Unit of 3 lever-type keys all with 2 locking and one normal position	Common-Battery Trunk	W.E.Co.	D-123321 per D-163181
Trunk		Key	Unit of 3 lever-type keys, 2 keys with 2 operating locking positions and one normal position, and one key with one normal, one locking, and one nonlocking, position	Magneto Trunks and Lines	"	D-159061 per D-163182
Station		Key	Same type and has same operating features as D-159061	Station Lines	"	D-123320 per D-163181
Attendants		Key	Same type and has same operating features as D-159061	Attendant's Telephone Circuit	"	529B per D-163181
Buzzer Ringing		Key	Singly mounted rotating-button type 2-locking positions	Buzzer and Pilot Lamp Control Emergency Ringing	"	498M per D-162254
Pilot		Lamp	Tungsten filament lamp 24 volts, 0.033 minimum, 0.045 maximum ampere	Auxiliary Signal	"	A1
Ring		Lamp	Tungsten filament; screwbase; 10 volts, 0.2 ampere, 30 volt, .039 ampere; 90 volt, 0.075 ampere	Resistance Lamp	"	12-B
Pilot		Lamp Cap, Green	Green opalescent cap	Auxiliary Signal	"	4F
A, B, C, D, E		Relay	Flat type with screw adjustment. Has metal shell 3-35/64"x1-11/16" x1-11/16": Has removable cap: Resistance of primary 16.4 ohms, secondary 22 ohms, combined resistance 9.4 ohms: After soak of 0.15 ampere operates on 0.015 ampere, releases on 0.005 ampere.	Supervisory Relays	"	B2 per D-161973
R		Relay	Return pole-piece type in case 4-1/8"x1-3/16"x1-3/32". Resistance of primary 1200 ohms, secondary 525 ohms. Operates on 0.0038 ampere does not operate on 0.0019 ampere.	Common-Battery Trunk Ringing Relay	"	186B per D-163176
S		Relay	Same as above	Auxiliary Signal Cutoff	"	B2 per D-161973
T		Relay	Single winding and same type same case as B2 relay. Resistance 50 ohms, operates on 0.0055 and releases on 0.0018 amperes	Auxiliary Signal	"	B21 per D-161973

Switchboard BD-116-B (Cont'd)

Reference Symbol	Stock No.	Name of Part	Description	Function	Manufacturer	Mfr. Part Number
A		Resistance	One winding on heat-resisting core 3-1/2"x1-3/16"x1/4", 500 ohms	Auxiliary Signal	W.E.Co.	18AC per D-161699
S		Resistance	Same type as 18AC - 100 ohms	Telephone Circuit	"	18U per D-161699
A, B, C, D, E		Signal	2-core unit approximately 2-13/16" x1"x3/4" signal has counterweight resistance 400 ohms, operates on 0.017 ampere, release 0.0015 ampere	Supervisory Signal	"	4J per D-163177
1 to 12		Signal	Same as 4J, different mounting centers	Station Line Signal	"	4K per D-163177
A, V		Varistor	Oxidized copper disc type unit has 6 discs 3/4" in diameter clamped to base	Telephone Circuit Click Reducer	"	33A per D-162708

(2) Protector and Terminal Box JB-66

	Binding Post	Nonremovable top with screwdriver slot	Line Connections	"	EBY TM197
	Heat Coil	Wire coil in round black insulating shell 21/32"x5/16", 3.45 ohms at 68F; operates on 0.54 ampere on 210 sec.	Line Protection	"	76A
	Protector Block	Plain carbon block 1x9/32"x5/32"	Line Protection	"	28
	Protector Block	Grooved porcelain frame with carbon insert 7/8"x23/64"x3/8"	Line Protection	"	29

(3) Power Panel PE-166

Reference Symbol	Stock No.	Name of Part	Description	Function	Manufacturer	Mfr. Part Number
		Static Ringing Generator	Output 0.1 ampere 75 volts	Furnishes 20-cycle Ringing Current	W.E.Co.	KS-5585, List 02
R1		Starting Relay		Starts 20-cycle oscillations	"	Start relay for static ringing generator per KS-5585, List 02
		Plug	Parallel blade, male base	Connects to power service	Hubbell	4897
		Receptacle	Parallel blade, female body	Connects to power service	Hubbell Bry.	6118 - 103
		Plug	Polarized male cap	Connects to switchboard	Hubbell Bry.	7479 TL-7479
		Receptacle	Twist lock, female base	Connects to switchboard	"	7468 TL-7468
T1		Transformer	Primary 477 turns No. 22 wire Secondary 179 turns No. 17 wire Secondary taps 1-2 5 turns 2-3 5 turns A-B 15 turns B-C 15 turns Sec. voltage 3 to C = 41.6 volts at 1.35 amperes	Reduces service voltage, provides means of adjusting voltage	W.E.Co.	D-164341
A		Selenium Varistor	4-3-4 full-wave disc rectifier	Rectification	"	KS-8972
		Ballast Lamp	Variable resistance to regulate output current	Regulation	"	5A Ballast Lamp
BAT CO		Switch	Double Pole Single Throw	Connects Power to Load	C. H.	Cut. 8910 K19
V		Voltmeter	0-50-volt direct current	Check output voltage	W.E.Co.	D-164339
		Battery	Signal Corps spec. 70-37, 55 amperehour 24 volts	Filter reserve battery supply	G.L.	BB-50
V		Fuse	2 amperes	Filter reserve battery supply	W.E.Co.	24C
		Fuse	1-1/3 ampere	-	W.E.Co.	35A
F1		Fuse	1.5 amperes	-	Littel.	1041
		Fuse extractor	-	Mounts fuse	"	1075A HKM
		Terminal Strips	10 posts	Transformer connections	Jones	6

(4) Tool Equipment

Quantity	Stock No.	Name	Description	Manufacturer	Manufacturer Part Number
1		Adjuster	Key adjuster	W.E.Co.	No. 303
1		Adjuster	Relay adjuster	"	No. 259
1		Burnisher	Contact Burnisher	"	No. 265
1		Brush	Small brush	"	KS-2993
1		Cloth	Cleaning Cloth	"	D-98063
1		Extractor	Lamp extractor	"	319B
1		Extracts	Lamp cap extractor	"	553A
1		Iron	Soldering iron	E.S.I.	Esico No. 96
1 pkg.		Paper	Bell seal bond	W.E.Co.	KS-7188
1 pkg.		Paper	Bell seal bond	"	KS-7187
2 oz. can		Paste	Soldering paste	Kester	
1		Screwdriver	Drop and signal screwdriver	W.E.Co.	KS-6854
1		Screwdriver	3" cabinet screwdriver		
1		Screwdriver	Relay screwdriver	W.E.Co.	KS-8210
1		Screwdriver	Wrench and screwdriver	"	R-1626
1		Screwdriver	Combination socket wrench and screwdriver	"	No. 220
1		Stick	Orange stick	"	KS-6320
2 rolls	6N8538	Tape	Friction tape	Jenkins	
2 rolls	6N8594	Tape	Rubber tape	"	
2 oz. can		Tetrachloride	C.P. carbon tetrachloride	-	-
1 pkg.		Toothpicks	Hardwood, flat on one end and pointed on other	-	-
1 lb roll		Solder	Resin core solder	Kester	-
1 lb roll		Wire	Solid wire	"	-
1		Wrench	Socket wrench	W.E.Co.	No. 48

(5) Test Equipment

Quantity	Stock No.	Name	Description	Manufacturer	Manufacturer Part Number
1		Book	Ledger (log and diary)	B and P	No. 38
1		Set	Portable test set	Conn. T. and E.	EE-65
1	3B2202	Tester	Hydrometer battery tester	Willard Storage Bat. Co.	Type HY-2

CIRCUIT REQUIREMENTS

SWITCHBOARD NO. BD116-B (STA LINE, TRKS, TEL, BUZ, RING)

APPARATUS DESIG.	APPARATUS CODE	MECH. REQ. BSP FIG.	MECH. REQ. CONT. PRESS.	MECH. REQ. ARM. TRVL.	CIRCUIT PREPARATION BLOCK OR INSULATE	TEST CLIP DATA CONN. BAT.	TEST CLIP DATA CONN. GRD.	TEST SET PREP.	SEE TEST NOTE NO.	DIRECT CURRENT FLOW REQ. TEST WDG.	TEST FOR	AFTER SOAK MA	TEST MA	READJ MA	REMARKS	DWG. ISS. 1	DWG. ISS. 2
RELAYS																	
L	56L DROP PER D-161895					L(L)	R(L)	B/G	1		O	-21		6.5			
						L(L)	R(L)	B/G	1		R	21		0 C			
									1		O		A-C				
R	186B PER D-163176				1/2 (R)	1T(R)	B(R)	B/G		P/S	O		4.2	3.8	OPEN T&R OF TRUNK		
					1/2 (R)	1T(R)	B(R)	B/G		P/S	NO		1.7	1.9			
L	56L DROP PER D-161895					L(L)	R(L)	B/G	1		O	-21		6.5			
						L(L)	R(L)	B/G	1		R	21		O.C.			
A TO E	B2 PER D-161973	2		30		2M (RELAY UNDER TEST)		GRD	2		O	150	16	15			
								GRD	2		R	150	4.7	5			

TEST NOTES:

1. (A) WHEN READJUSTNG OPEN RING OF TRUNK. TEST ON RINGING CURRENT FROM CENTRAL OFFICE.

   (B) WHEN TESTING AND READJUSTING OPEN RING OF TRUNK. TEST FOR OPERATION ON A-C BY CONNECTING 105V. 1100-1200 R.P.M. RINGING CURRENT THRU 11,000Ω NON-INDUCTIVE RES. TO OUTER WDG. (R) REL. AND RINGING GRD. TO TIP OF TRUNK TOWARDS CENTRAL OFFICE. THE ABOVE REQUIREMENTS ARE BASED UPON THE USE OF ONE 13C OR EQUIVALENT RES. LAMP IN SERIES WITH RINGING SUPPLY.

2. WHEN TEST SET D-162269 IS USED, APPLY SOAK BY OPERATING (SOAK) KEY.

Figure 13 - Circuit Requirement Table

CIRCUIT REQUIREMENTS

APPARATUS DESIG.	APPARATUS CODE	MECH. REQ. BSP FIG.	MECH. REQ. CONT. PRESS.	MECH. REQ. ARM. TRVL.	CIRCUIT PREPARATION BLOCK OR INSULATE	TEST CLIP DATA CONN. BAT.	TEST CLIP DATA CONN. GRD.	TEST SET PREP.	SEE TEST NOTE NO.	DIRECT CURRENT FLOW REQ. TEST WDG.	TEST FOR	AFTER SOAK MA	TEST MA	READJ MA	REMARKS	DWG. ISS. 1	DWG. ISS. 2
A TO E	4J SIG. PER D-163177						R SIG. UNDER TEST	GRD	1		O		19	17			
								GRD			R		1.3	1.5			
1 TO 12	4K SIG. PER D-163177						R SIG. UNDER TEST	GRD			O		19	17			
								GRD	2		R		1.3	1.5			
S	B2 PER D-161973	2		30		1M(S)	2M(S)	B/G	1		O	150	16	15			
						1M(S)	2M(S)	B/G	1		R	150	4.7	5			
MAGNETS																	
B	4C PER D-161879 BUZZER								3								
RELAYS																	
T	B21 PER D-161973	1		30			2M(T)	GRD	1		O	225	5.2	4.9			
							2M(T)	GRD	1		R	225	1.7	1.8			

TEST NOTES:

1. WHEN TEST SET D-162269 IS USED, APPLY SOAK BY OPERATING (SOAK) KEY.
2. OPERATE STATION KEY (A) WHEN TESTING OR READJUSTING.
3. THE 4C BUZZER SHALL BE TESTED AND READJUSTED TO OPERATE SATISFACTORILY IN THE CIRCUIT WHEN THE (T) REL. IS BLOCKED OPERATED.
4. TURN (BUZZER) KEY TO (LAMP) POSITION WHEN TESTING OR READJUSTING.

Figure 14 - Circuit Requirement Table

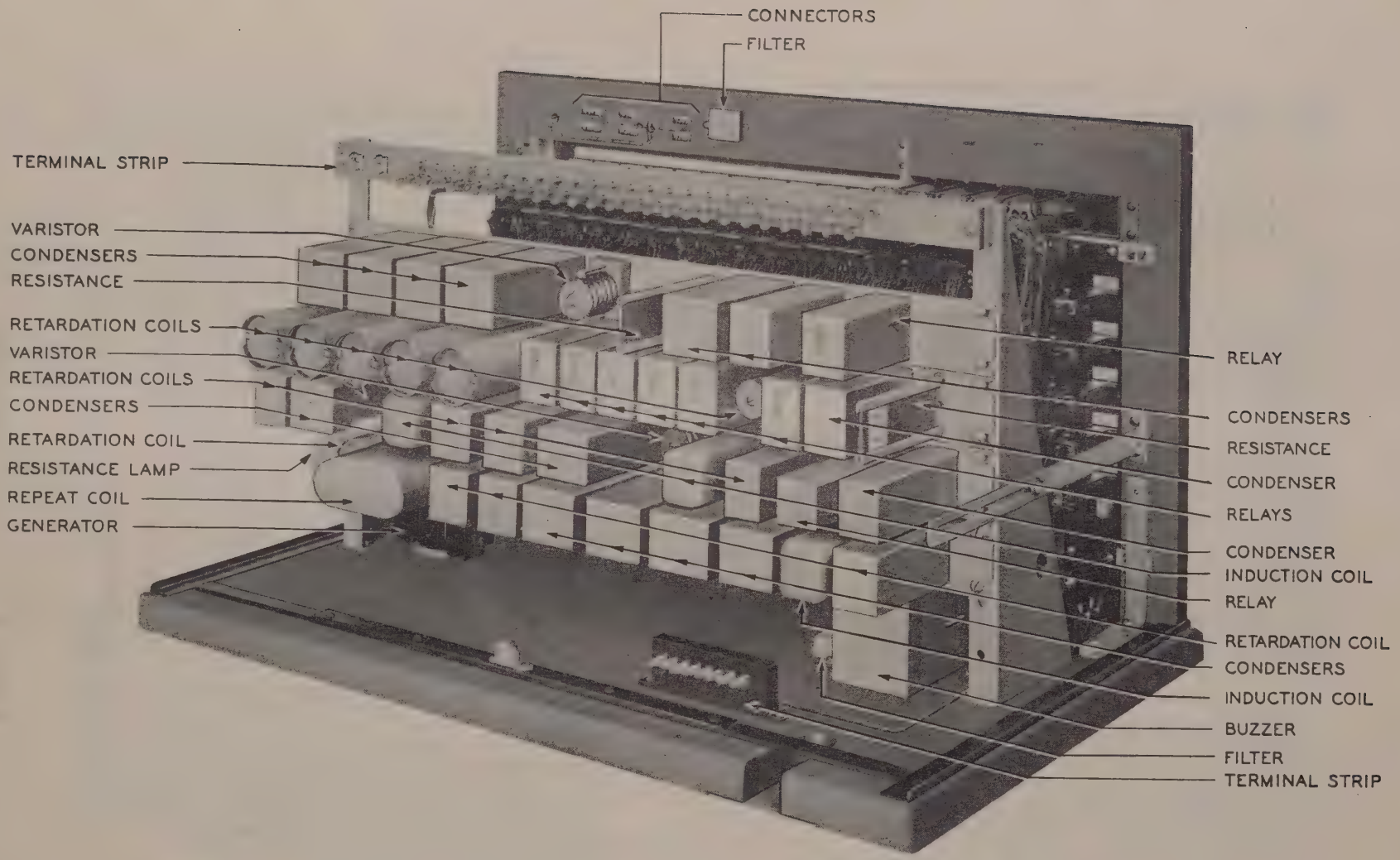


Figure 15 - Switchboard BD-116-B, Rear View, Cover Removed

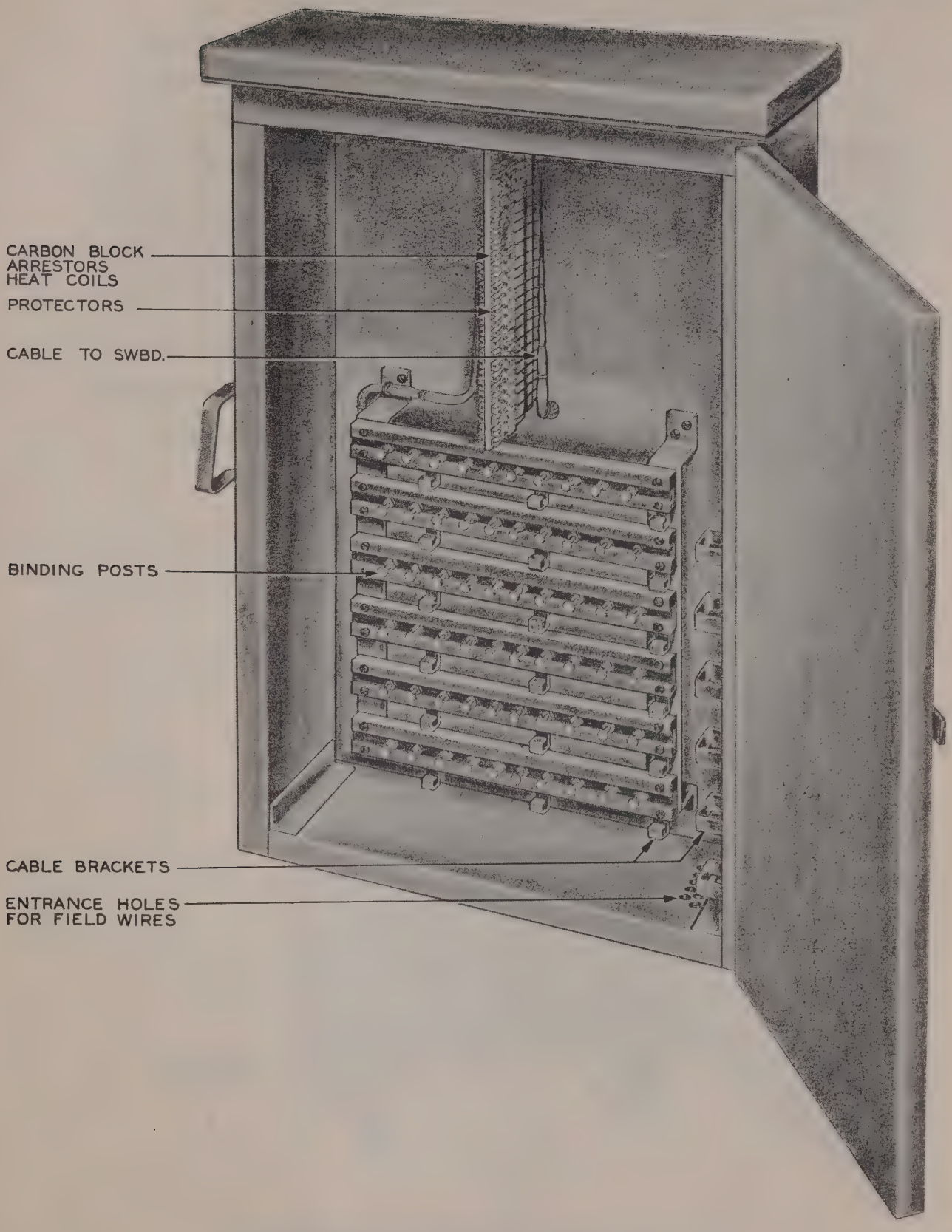


Figure 16 - Protector and Terminal Box JB-66

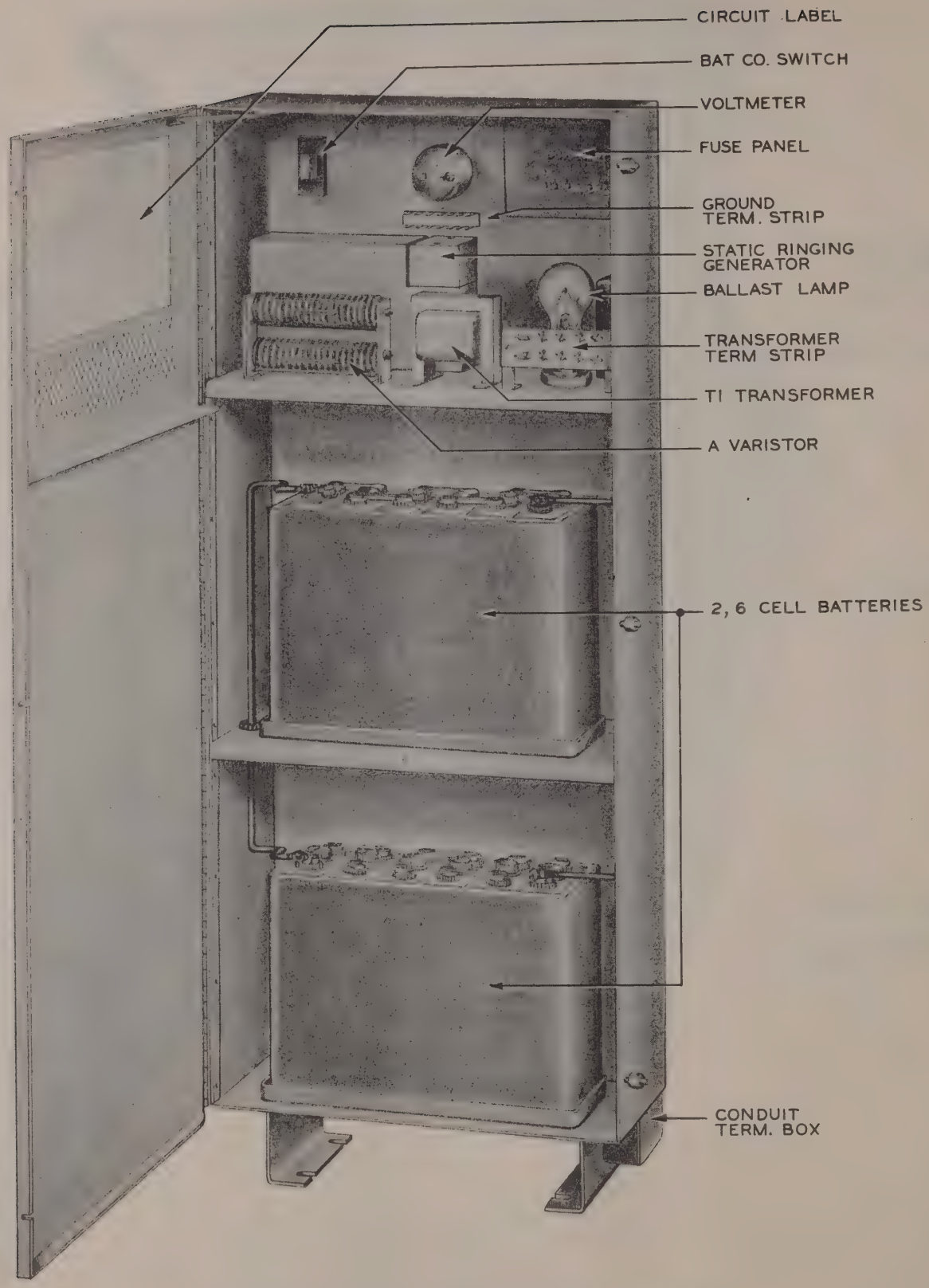
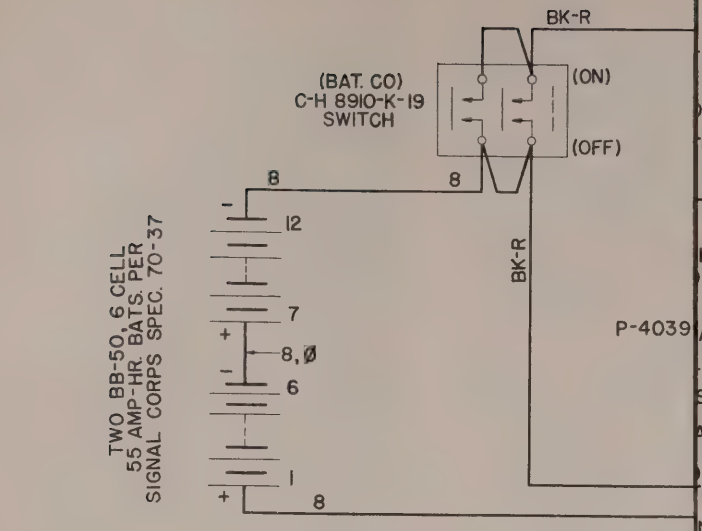
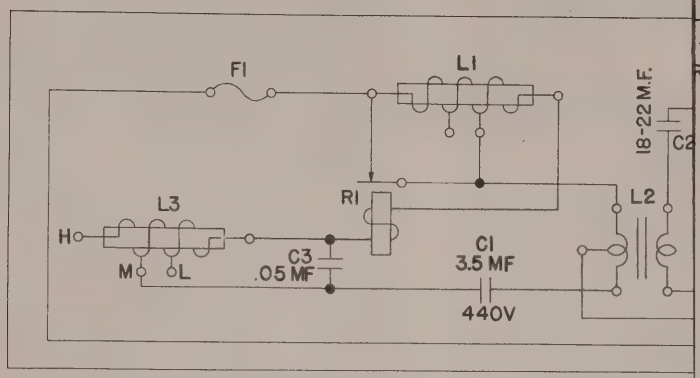
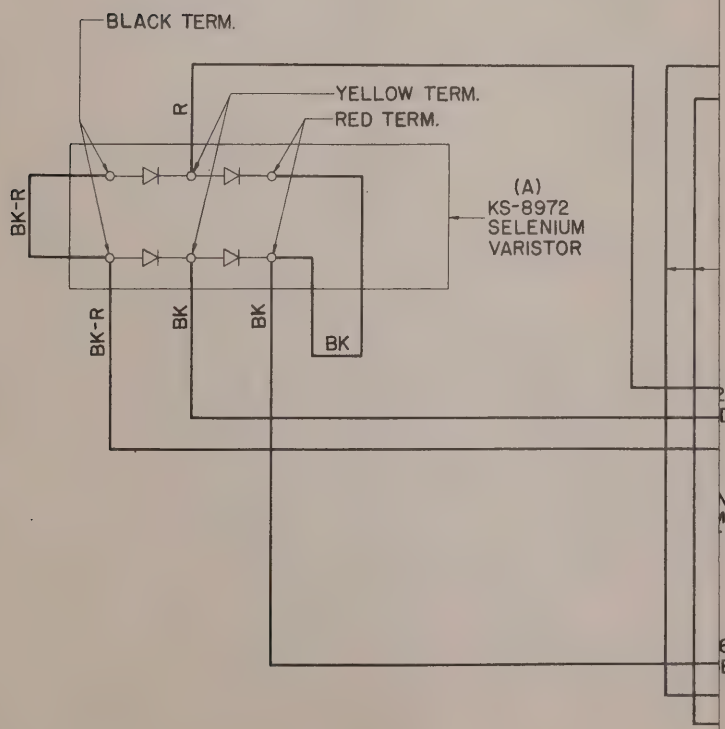


Figure 17 - Power Equipment PE-166





KS-5585 LIST 02
STATIC RINGING GENERATOR



HERWISE SPECIFIED ALL LEADS TO BE 14-AM. 8 AND
BE WIRE OR CABLE PER KS-5482.

TES SPLICE.

ES LEADS PART OF APPARATUS.

SHALL BE RUN PARALLEL OR PERPENDICULAR TO
HE SHELF AND PANEL IN THE SHORTEST POSSIBLE

IGNATED Ø SHALL BE RUN BY THE INSTALLER. LEADS
THUS ARE THE BATTERY LEAD AND THE LEAD TO
PIPE OR OTHER GROUND.

AND TERMINAL SHALL BE CONNECTED TO TERM. 1 ON
OF TERM. BLOCK AND ENOUGH SLACK SHALL BE LEFT
CAN BE RECONNECTED TO TERMINALS 2 OR 3 AT
STALLATION.

AND TERMINAL SHALL BE CONNECTED TO TERM. A ON
SIDE OF THE TERM. BLOCK AND ENOUGH SLACK SHALL
THAT IT CAN BE RECONNECTED TO TERMINALS B
IME OF INSTALLATION.

NECTED TO ZIERICK TERMINALS SHALL PASS THRU
IN TERMINAL BLOCK ADJACENT TO THE ASSOCIATED
LISTED IN NOTES 6 & 7.

THE RECTIFIER OUTPUT SHIFT THE LEADS WITH
RMINALS ON TERMINAL BLOCK.

NG
ELF

D.

NG

60 ~
E

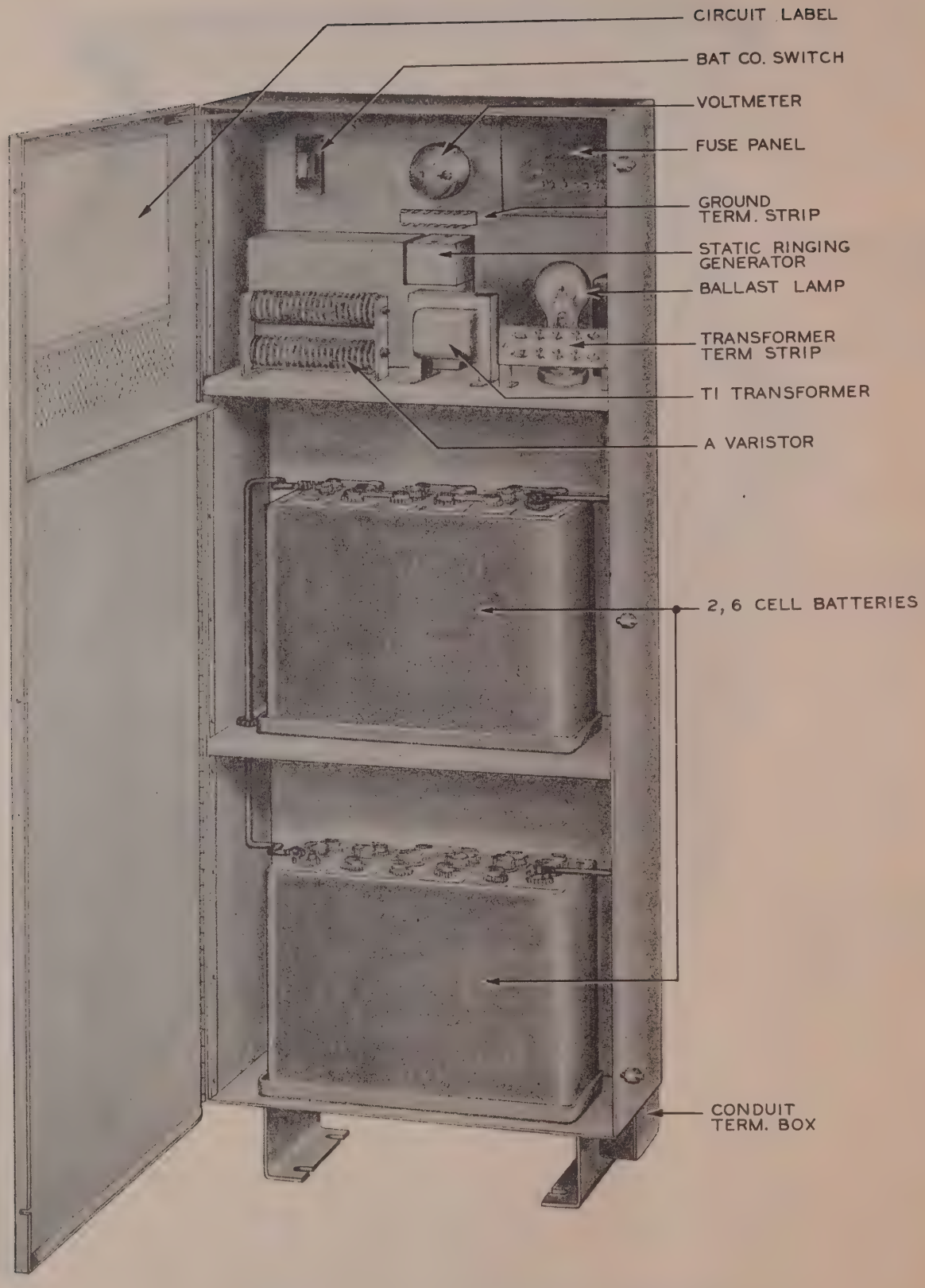
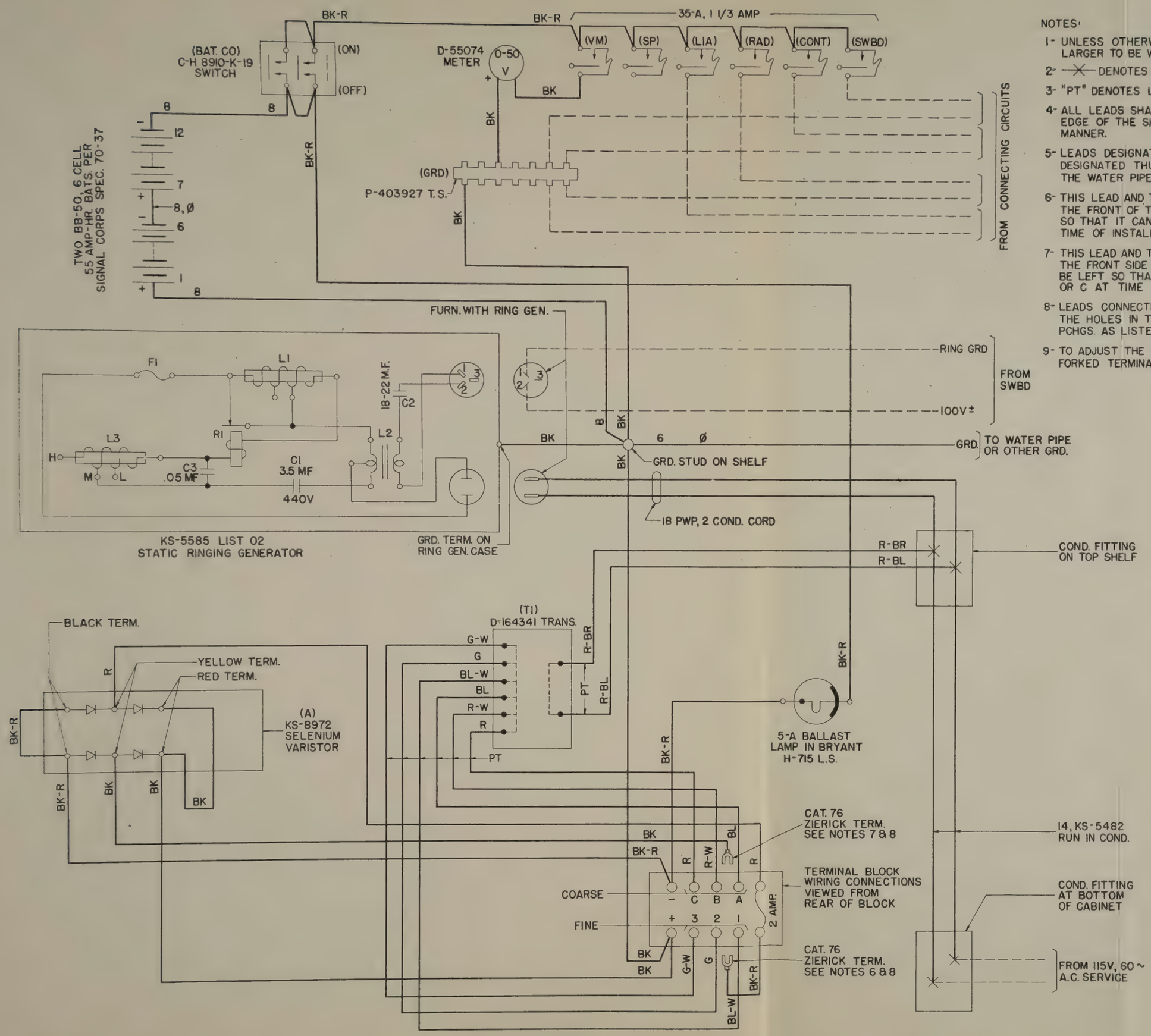


Figure 17 - Power Equipment PE-166



NOTES:

1- UNLESS OTHERWISE SPECIFIED ALL LEADS TO BE 14-AM. 8 AND LARGER TO BE WIRE OR CABLE PER KS-5482.

2- —X— DENOTES SPLICE.

3- "PT" DENOTES LEADS PART OF APPARATUS.

4- ALL LEADS SHALL BE RUN PARALLEL OR PERPENDICULAR TO EDGE OF THE SHELF AND PANEL IN THE SHORTEST POSSIBLE MANNER.

5- LEADS DESIGNATED Ø SHALL BE RUN BY THE INSTALLER. LEADS DESIGNATED THUS ARE THE BATTERY LEAD AND THE LEAD TO THE WATER PIPE OR OTHER GROUND.

6- THIS LEAD AND TERMINAL SHALL BE CONNECTED TO TERM. 1 ON THE FRONT OF TERM. BLOCK AND ENOUGH SLACK SHALL BE LEFT SO THAT IT CAN BE RECONNECTED TO TERMINALS 2 OR 3 AT TIME OF INSTALLATION.

7- THIS LEAD AND TERMINAL SHALL BE CONNECTED TO TERM. A ON THE FRONT SIDE OF THE TERM. BLOCK AND ENOUGH SLACK SHALL BE LEFT SO THAT IT CAN BE RECONNECTED TO TERMINALS B OR C AT TIME OF INSTALLATION.

8- LEADS CONNECTED TO ZIERICK TERMINALS SHALL PASS THRU THE HOLES IN TERMINAL BLOCK ADJACENT TO THE ASSOCIATED PCHGS. AS LISTED IN NOTES 6 & 7.

9- TO ADJUST THE RECTIFIER OUTPUT SHIFT THE LEADS WITH FORKED TERMINALS ON TERMINAL BLOCK.

Figure 18 - Power Equipment, Circuit Label

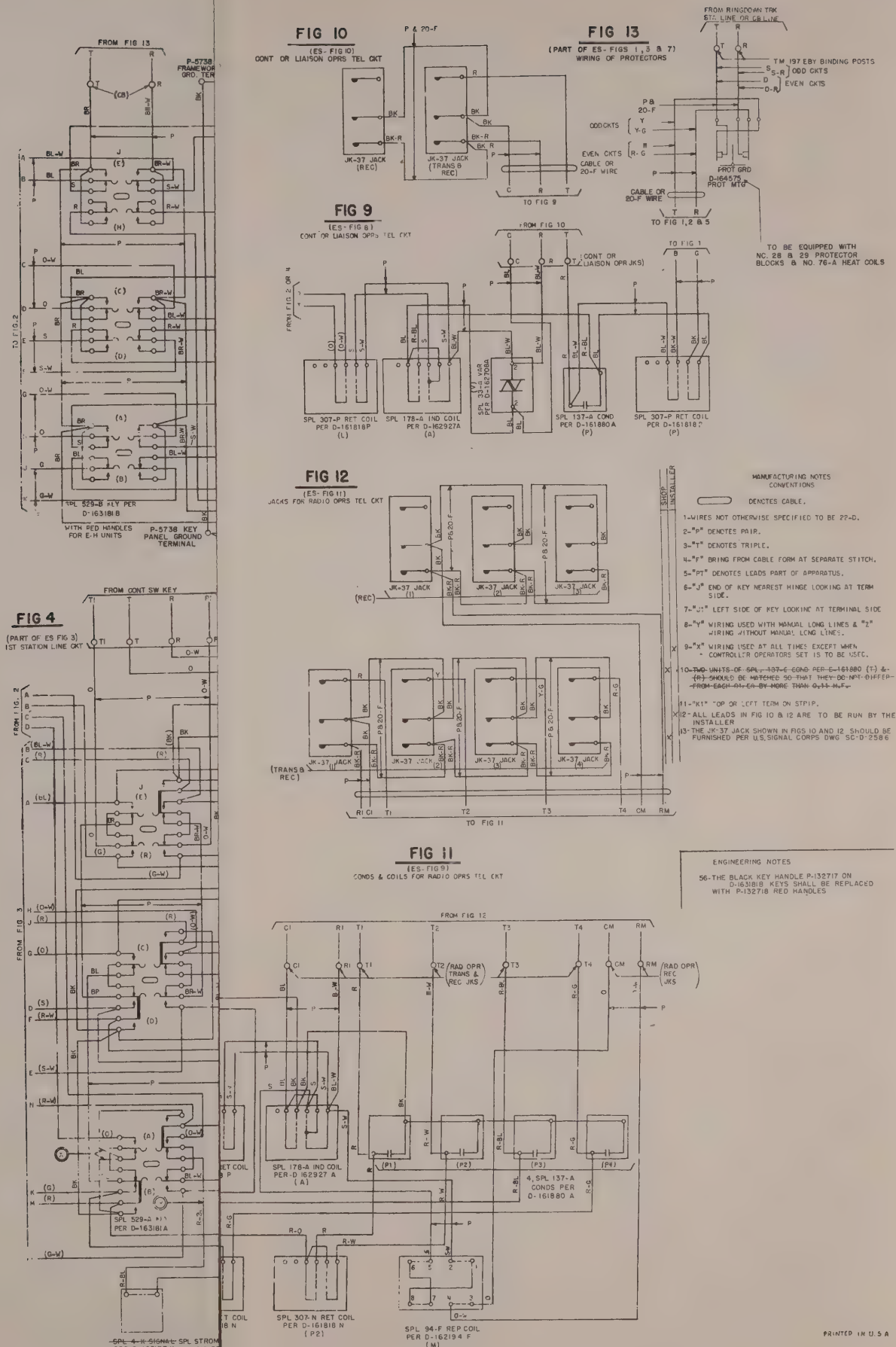


FIG 10
(ES-FIG 10)
CONT OR LIAISON OPRS TEL CKT
FIG 13
(PART OF ES-FIGS 1, 3 & 7)
WIRING OF PROTECTORS
FIG 9
(ES-FIG 8)
CONT OR LIAISON OPRS TEL CKT
FIG 12
(ES-FIG 11)
JACKS FOR RADIO OPRS TEL CKT
FIG 4
(PART OF ES FIG 3)
1ST STATION LINE CKT
FIG 11
(ES-FIG 9)
CONDS & COILS FOR RADIO OPRS TEL CKT
MANUFACTURING NOTES
CONVENTIONS
DENOTES CABLE.
1-WIRES NOT OTHERWISE SPECIFIED TO BE 22-D.
2-"P" DENOTES PAIR.
3-"T" DENOTES TRIPLE.
4-"F" BRING FROM CABLE FORM AT SEPARATE STITCH.
5-"PT" DENOTES LEADS PART OF APPARATUS.
6-"J" END OF KEY NEAREST HINGE LOOKING AT TERM SIDE.
7-"JL" LEFT SIDE OF KEY LOOKING AT TERMINAL SIDE
8-"Y" WIRING USED WITH MANUAL LONG LINES & "Z" WIRING WITHOUT MANUAL LONG LINES.
9-"X" WIRING USED AT ALL TIMES EXCEPT WHEN CONTROLLER OPERATORS SET IS TO BE USED.
10-TWO UNITS OF SPL 137-C COND PER E-161880 (T) & (R) SHOULD BE MATCHED SO THAT THEY DO NOT DIFFER FROM EACH OTHER BY MORE THAN 0.1% MFD.
11-"KT" TOP OR LEFT TERM ON STRIP.
12-ALL LEADS IN FIG 10 & 12 ARE TO BE RUN BY THE INSTALLER
13-THE JK-37 JACK SHOWN IN FIGS 10 AND 12 SHOULD BE FURNISHED PER U.S.SIGNAL CORPS DWG SC-D-2586
ENGINEERING NOTES
56-THE BLACK KEY HANDLE P-132717 ON D-163181B KEYS SHALL BE REPLACED WITH P-132718 RED HANDLES
TO BE EQUIPPED WITH NO. 28 & 29 PROTECTOR BLOCKS & NO. 76-A HEAT COILS
WITH RED HANDLES FOR E-H UNITS
P-5738 KEY PANEL GROUND TERMINAL

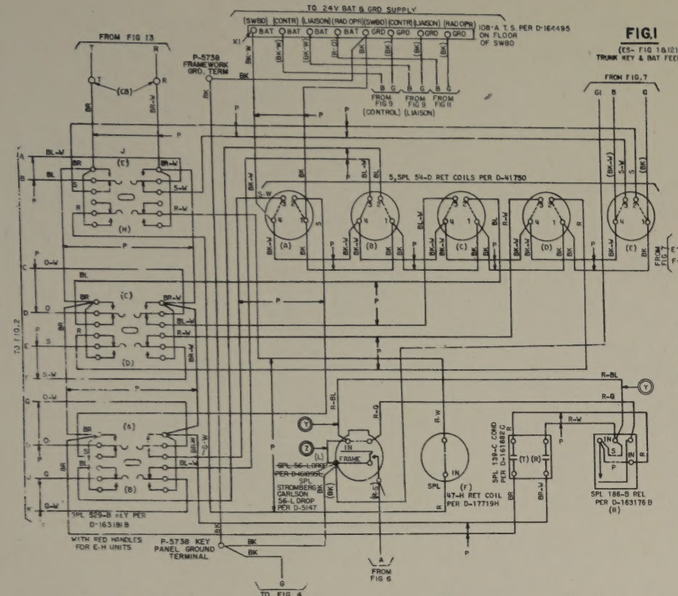
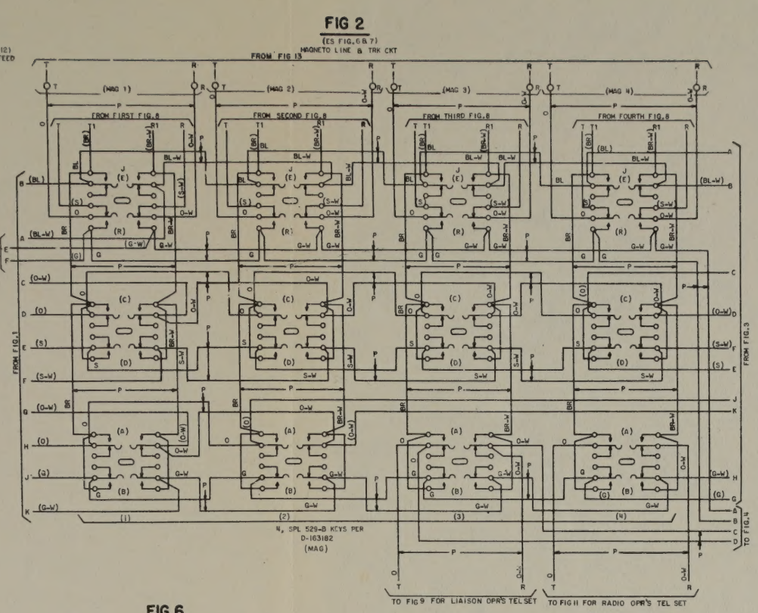


FIG 1
(ES- FIG 1&12)
TRUNK KEY & BAT FEED
TO 24V BAT & GRD SUPPLY
FROM FIG 13
FROM FIG 7
P-5738 FRAMEWORK GRD. TERM
5, SPL 54-D RET COILS PER D-41750
SPL 529-B KEY PER D-163181B
WITH RED HANDLES FOR E-H UNITS
P-5738 KEY PANEL GROUND TERMINAL
SPL 56-L CORD
SPL STROMBERG CARLSON 56-L DROP PER D-5147
SPL 47-N RET COIL PER D-17719H
SPL 186-B REL PER D-163176 B
SPL 139-A COND PER D-161882C
TO FIG 4
FROM FIG 6



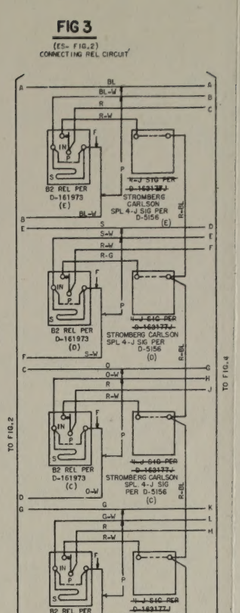


FIG 3
(ES- FIG.2)
CONNECTING REL CIRCUIT
B2 REL PER D-161973 (C)
STROMBERG CARLSON SPL 4-J SIG PER D-5156 (C)
B2 REL PER D-161973 (D)
STROMBERG CARLSON SPL 4-J SIG PER D-5156 (D)
B2 REL PER D-161973 (C)
STROMBERG CARLSON SPL 4-J SIG PER D-5156 (B)
B2 REL PER D-161973 (B)
STROMBERG CARLSON SPL 4-J SIG PER D-5156 (A)
FROM FIG.6
TO FIG.2
TO FIG.4
TO FIG.5

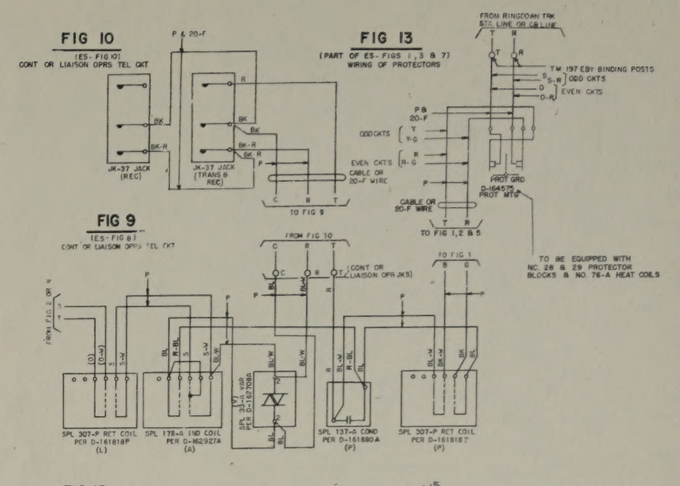


FIG 10
(ES- FIG 10)
CONT OR LIAISON OPRS TEL CKT
JK-37 JACK (REC)
JK-37 JACK (TRANS & REC)
TO FIG 9
FIG 13
(PART OF ES- FIGS. 1, 5 & 7)
WIRING OF PROTECTORS
FROM RINGDOWN TRK S.T. LINE OR C.B LINE
TM 197 EBY BINDING POSTS
ODD CKTS
EVEN CKTS
PROT GRD D-164575 PROT MTG
CABLE OR 20-F WIRE
TO FIG 1,2 & 5
FIG 9
(ES- FIG 8)
CONT OR LIAISON OPR'S TEL CKT
FROM FIG 10
TO FIG 1
(CONT OR LIAISON OPR JKS)
TO BE EQUIPPED WITH NO. 28 & 29 PROTECTOR BLOCKS & NO. 76-A HEAT COILS
SPL 307-P RET COIL PER D-161818P (L)
SPL 178-B IND COIL PER D-162927A (A)
SPL 137-C COND PER D-161880A (P)
SPL 307-P RET COIL PER D-161818P (P)
FIG 12
(ES- FIG 11)
JACKS FOR RADIO OPRS TEL CKT
JK-37 JACK (REC)
JK-37 JACK (TRANS & REC)
TO FIG 11
MANUFACTURING NOTES
CONVENTIONS
DENOTES CABLE.
1-WIRES NOT OTHERWISE SPECIFIED TO BE 22-G.
2-"P" DENOTES PAIR.
3-"T" DENOTES TRIPLE.
4-"F" BRING FROM CABLE FORM AT SEPARATE STITCH.
5-"PT" DENOTES LEADS PART OF APPARATUS.
6-"J" END OF KEY NEAREST HINGE LOOKING AT TERM SIDE.
7-"X": LEFT SIDE OF KEY LOOKING AT TERMINAL SIDE
8-"Y" WIRING USED WITH MANUAL LONG LINES & "Z" WIRING WITHOUT MANUAL LONG LINES.
9-"X" WIRING USED AT ALL TIMES EXCEPT WHEN CONTROLLER OPERATORS SET IS TO BE USED.
10-TWO UNITS OF SPL 133-C COND PER D-161880 (T) & (R) SHOULD BE MATCHED SO THAT THEY DO NOT DIFFER FROM EACH OTHER BY MORE THAN 0.45 M.F.
11-"X1" TOP OR LEFT TERM ON STRIP.
12-ALL LEADS IN FIG 10 & 12 ARE TO BE RUN BY THE INSTALLER
13-THE JK-37 JACK SHOWN IN FIGS 10 AND 12, SHOULD BE FURNISHED PER U.S. SIGNAL CORPS DWG SC-D-2586
FIG 11
(ES- FIG 9)
CONDS & COILS FOR RADIO OPRS TEL CKT
FROM FIG 12
SPL 307-P RET COIL PER D-161818P (L)
SPL 178-A IND COIL PER D-162927A (A)
4, SPL 137-A CONDS PER D-161880 A
SPL 307-N RET COIL PER D-161818 N (P1)
SPL 307-N RET COIL PER D-161818 N (P2)
SPL 94-F REP COIL PER D-162194 F (M)
TO FIG 11
ENGINEERING NOTES
56-THE BLACK KEY HANDLE P-132717 ON D-163181B KEYS SHALL BE REPLACED WITH P-132718 RED HANDLES
PRINTED IN U.S.A.

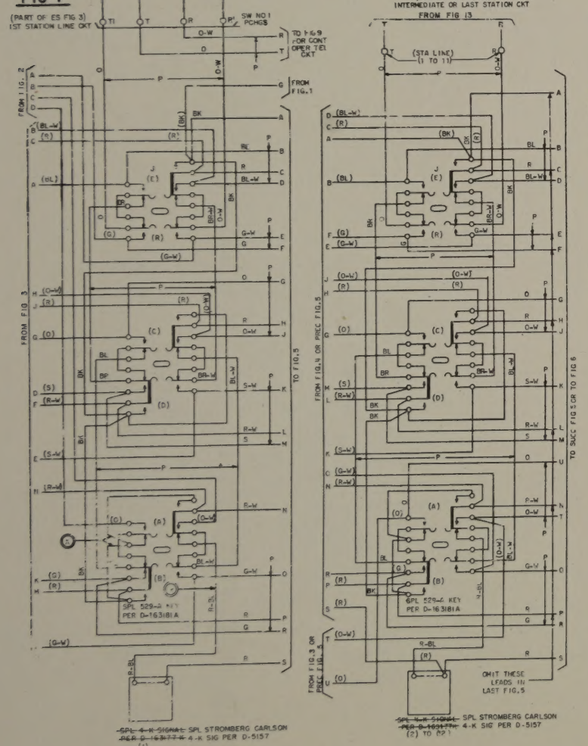


FIG 4
(PART OF ES FIG 3)
1ST STATION LINE CKT
FROM CONT SW KEY
SW NO 1 PCHGS
TO 1-G,9 OR CONT OPER TEL CKT
FROM FIG.1
TO FIG.5
FROM FIG.3
SPL 529-B KEY PER D-163181A
SPL 529-G KEY PER D-163181A
SPL 4-K SIGNAL SPL STROMBERG CARLSON PER D-161777 4-K SIG PER D-5157
(1)

FIG 5
(PART OF ES-FIG.3)
INTERMEDIATE OR LAST STATION CKT
FROM FIG 13
(STA LINE) (1 TO 11)
FROM FIG.3
FROM FIG.5
SPL 529-B KEY PER D-163181B
SPL 529-G KEY PER D-163181A
OMIT THESE LEADS IN LAST FIG.5
SPL STROMBERG CARLSON PER D-161777 4-K SIG PER D-5157
(2) TO REP

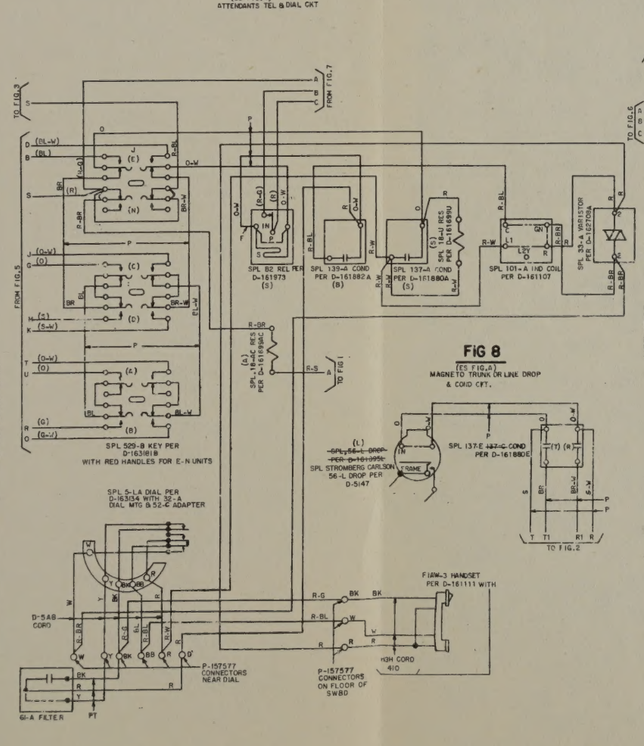


FIG 6
(ES FIG.4)
ATTENDANTS TEL & DIAL CKT
FROM FIG.7
TO FIG.3
FROM FIG.5
SPL 82 REL PER D-161973 (S)
SPL 139-A COND PER D-161882A (B)
SPL 137-A COND PER D-161880A (S)
SPL 101-A IND COIL PER D-161107
SPL 30-A VARISTOR PER D-161963
SPL 12-J RES PER D-161896C
TO FIG.1
SPL 529-B KEY PER D-163181B
WITH RED HANDLES FOR E-N UNITS
SPL 5-LA DIAL PER D-163134 WITH 32-A DIAL MTG & 52-C ADAPTER
D-5A8 CORD
G-A FILTER
P-157577 CONNECTORS NEAR DIAL
FIG 8
(TO FIG.A)
MAGNETO TRUNK OR LINE DROP & COND CKT.
SPL 137-E 137-G COND PER D-161880E
SPL STROMBERG CARLSON 56-L DROP PER D-5147
FIRM-3 HANDSET PER D-161111 WITH
P-157577 CONNECTORS ON FLOOR OF SWBD
TO FIG.2

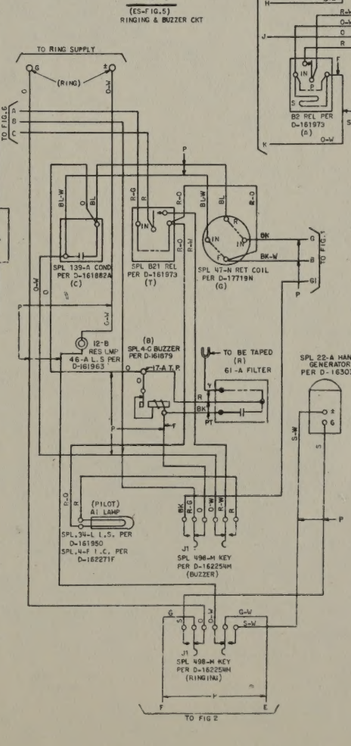
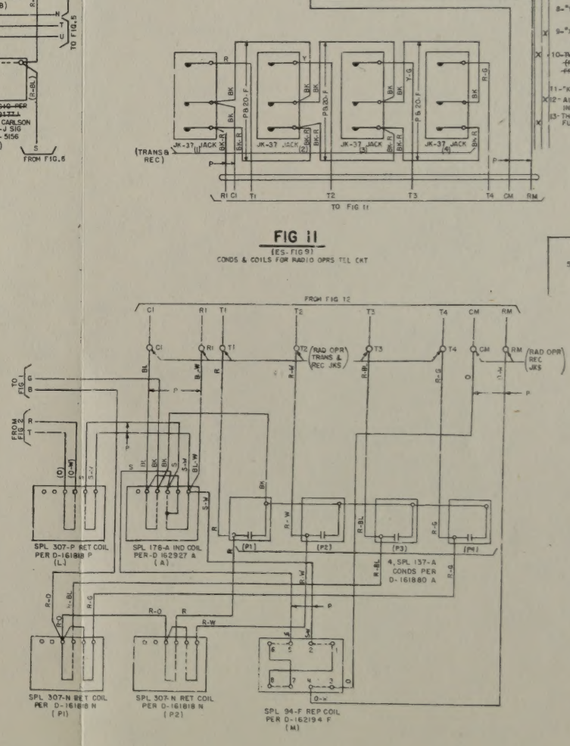


FIG 7
(ES-FIG.5)
RINGING & BUZZER CKT
TO RING SUPPLY
(RING)
FROM FIG.6
TO FIG.5
SPL 139-A COND PER D-161882A (C)
SPL B21 REL PER D-161973 (T)
SPL 47-N RET COIL PER D-17719N (G)
12-B RES LMP 46-A-L S PER D-161963
(B) SPL 4-C BUZZER PER D-161979
TO BE TAPED (R) 61-A FILTER
SPL 22-A HAND GENERATOR PER D-163037
(PILOT) A1 LAMP
SPL 94-L L.S. PER D-161950
SPL 4-F I.C. PER D-162271F
SPL 498-M KEY PER D-162254M (BUZZER)
SPL 498-M KEY PER D-162254M (RINGING)
TO FIG 2


FROM FIG 12
TO FIG 1
FROM FIG 1
SPL 307-P RET COIL PER D-161818P (L)
SPL 178-A IND COIL PER-D 162927 A (A)
4, SPL 137-A CONDS PER D-161880 A
SPL 307-N RET COIL PER D-161818 N (P1)
SPL 307-N RET COIL PER D-161818 N (P2)
SPL 94-F REP COIL PER D-162194 F (M)
(RAD OPR TRANS & REC JKS)
(RAD OPR REC JKS)

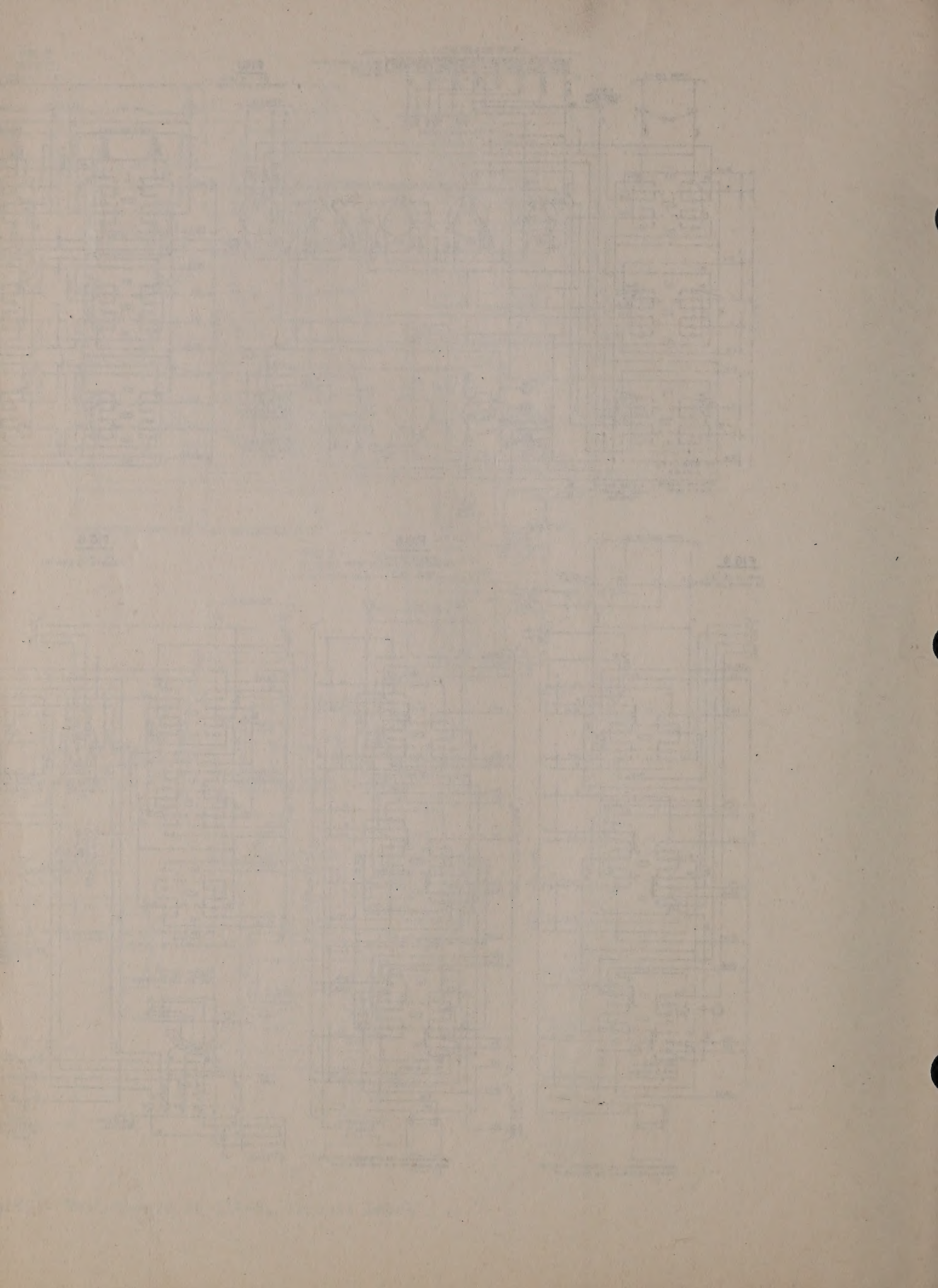



Figure 19 - Switchboard BD-116-B, Circuit Label